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1909-1911

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# CANALS AND NAVIGABLE RIVERS IN THE DISTRICT OF BERLIN, GERMANY.

## LETTER

FROM

HON. FRANK H. MASON, CONSUL-GENERAL, BERLIN, GERMANY, TO THE ASSISTANT SECRETARY OF STATE, DEPARTMENT OF STATE, WASHINGTON, D. C., TRANSMITTING REPORT ON THE CANALS AND NAVIGABLE RIVERS IN THE DISTRICT OF BERLIN.

CONSULATE-GENERAL OF THE UNITED STATES,
*Berlin, Germany, July 22, 1903.*

HON. FRANCIS B. LOOMIS,
*Assistant Secretary of State, Washington, D. C.*

SIR: I have the honor to inclose herewith my report made in compliance with general instructions dated May 8, 1903, on the canals and navigable rivers in the district of Berlin.

In respect to the form and scope of this report, I have to state that before receiving the instruction of May 8 I received letters from Hon. Theodore E. Burton, chairman of the House Committee on Rivers and Harbors, by whom the instruction had been inspired, stating that he was then in France and would reach Berlin soon after the middle of July. Mr. Burton wrote quite fully as to the information he specially desired to obtain, and the examinations he desired to make in and about Berlin. I at once set to work collecting literature and information relating to the navigable waterways of this district, and on his arrival at Berlin, July 14, a systematic plan of operation was agreed upon. Mr. Burton is accompanied by Major Mahan, of the U. S. Corps of Engineers, who will make an elaborate technical report for the information of the Committee on Rivers and Harbors.

It was agreed that my report, instead of following the interrogatories of the circular of May 8, which are for the most part general and relate to seaports and other subjects foreign to an inland consulate, should be descriptive and confined to the very important river and canal system of the Elbe-Oder-Spree-Havel region, which is substantially the consular district of Berlin.

I am, sir, very respectfully, your obedient servant,

FRANK H. MASON,
*Consul-General.*

## CANALS AND NAVIGABLE RIVERS IN THE DISTRICT OF BERLIN.

Germany is notable among European countries for the number, length, and symmetrical geographical distribution of her navigable rivers, and for the skill and enterprise with which these natural water courses have been deepened, improved, supplemented by lateral canals, and adapted by artificial means to the requirements of inland transportation. The Weichsel, which flows from Warsaw to the Baltic, with Königsberg and Danzig as its seaports, the Oder, with the Warthe as an affluent, debouching in the great harbor at Stettin; the Spree and Havel, which, with their network of canals reaching to the Elbe and Oder, have made possible the building and prosperity of Berlin; the Elbe, bringing the commerce of Saxony, Magdeburg, and all central Germany down to Hamburg; the Weser, which makes a vast area of west central Germany tributary to Bremen, and the Rhine, with its branches, the navigable Main, the Ems and Mosel, threading the whole western portion of the Empire, these are gifts of nature which have been most potent in the industrial and commercial development of the Fatherland.

As early as 1875, five years after the consolidation of the Empire, Germany had in service 5,625 miles of inland waterways on which were carried during that year 10,400,000 tons of incoming and 9,200,000 tons of outgoing freight, the total service being reckoned at 2,754,000,000 ton-kilometers. In 1900 the length of navigable waterways had been increased to 9,450 kilometers (5,906 miles) and the traffic had grown to 40,400,000 tons of arriving and 31,800,000 tons of departing freight, with an aggregate service of 11,390,000,000 ton-kilometers. These figures cover only the inland river and canal transportation, and have no reference to the seagoing commerce of ports like Hamburg, Bremen, and Stettin. As a basis of comparison, it may be stated that Germany had in service in 1900, 49,600 kilometers (about 31,000 miles) of railway, which carried during the year 487,000,000 tons of freight, so that of the whole 559,200,000 tons of inland freight transported in Germany that year 76 per cent was carried by rail and 24 per cent by water.

*The Elbe-Oder-Spree-Havel River and Canal System.*—Berlin is located in the midst of the level, sandy plain of Brandenburg, about midway between the Oder, which flows down on the east from Upper Silesia past Breslau and Frankfort to Stettin, and the Elbe, which is navigable from Hamburg up past Magdeburg to Schandau beyond Dresden. Between these main arteries of river traffic flow the Spree, a short, tortuous, and variable river, which widens at many points into small ponds or lakes, and, after flowing through Berlin, discharges its waters at Spandau into the Havel, a bayou or chain of lakes which has its source in the Province of Mecklenburg, and flows thence southward past Potsdam, where it turns westward, and after many meanderings, during which it frequently widens to a shallow lake or narrows to a deep channel, it flows into the Elbe at Havelburg, about midway between Magdeburg and Hamburg. Throughout this whole region, the consular district of Berlin, the country is so nearly level that the few streams have only sufficient fall to give them a sluggish, uncertain current. The ground is sandy, easily excavated, almost destitute of rock, but so loose and unstable as to

# Die Märkischen Wasserstr.

Längen 1:1000000.

Höhen 1:1000.

## Längenschnitt: Niegripp – Spandau – Hohensaathen.

Ihle Kanal — Plauer Kandl — Havel — Oranienbg u. Malz Kanal — Finow Kanal

M.W.

Horizont. = N.N.

Elbe | Ihle | Elbe | Ihle | Cade | Plaue | Brandenburg | Marquart | Spandau | Pinnow | Oranienburg | Malz | Liebenwalde | Zerpenschleuse | Schöpfurth | Eberswalde | Lippe | Hohensaathen | Oder

## Längenschnitt: Havelberg – Spandau – Fürstenberg O.

Havel — Spree — Dahme — Spree-Oder-Kanal — Friedr. Wilh. Kanal

M.W.

Horizont. = N.N.

Elbe | Havelberg | Gahlberg | Rathenow | Plaue | Brandenberg | Marquart | Spandau | Charlotten-burg | Berlin | Copenick | Wernsdorf | Fürstenwalde | Kersdorf | Brieskow | Oder | Fürstenberg | Oder

## Übersichtskarte

Wittenberge · Neu Ruppin · Zehdenick · Lindow · Werbellin-See · Alte Oder · Hohensaathen · Lippe · Oderberg · Havelberg · Liebenwalde · Malz · Eberswalde · Freienwalde · Wriezen · Landsberg · Mietzel · Warthe · Oder · Cüstrin · Frankfurt · Brieskow · Fürstenberg · Rathenow · Tangermünde · Oranienburg · Pinnow · Hennigsdorf · Berlin · Spandau · Charlottenburg · Potsdam · Ketzin · Brandenburg · Köpenick · Rüdersdorf · Fürstenwalde · Kersdorf · Müllrose · Beeskow · Alt-Schadow · Niegripp · Ihlekanal · Ihleburg · Gnadthin · Cade · Plauer See · Plauer Kanal · Plaue · Schwielow-See · Zeltow-Kanal · Spree · Spree-Oder-Kanal · Friedr. Wilh. Kanal · Finow-Kanal · Oranienburger Kanal · Malzkanal · Hohenzollern-Kanal · Havelländ. Hauptgraben · Briesetang · Dosse · Rhin-Kanal · Elbe · Havel · Alandkanal · Geplanter Mittelland-Kanal · Magdeburg.

—·—·— Project. Wasserstr. Berlin-Hohensaathen (Westlinie)

require extensive revetments of masonry, timber, etc., to secure the shores of canals and other waterways from abrasion.

It has been the work of nearly two centuries to widen and deepen the Spree, to overcome by artificial means the shallows and other deficiencies of the Havel, to connect them with each other and with the Oder on the east and the Elbe on the west by an elaborate system of canals with locks and sluices for the control of floods, until the Berlin of modern times is the center and mart of a labyrinth of canals and canalized water courses, crowded with boats, which bring the coal and briquettes of Silesia, timber, stone, bricks, lime, fruit, and other heavy freights from the interior and give the capital direct water transportation to Hamburg and Stettin. It is within bounds to say that but for the combination of natural and artificial water courses for the easy and cheap transport of fuel, building, and other raw materials, the modern city of Berlin, with its 2,000,000 of inhabitants and its vast and varied industries, would have been economically impossible.

As early as 1750 the natural facilities offered by the Spree and Havel became inadequate for the growing requirements of commerce and the process of enlarging and extending them by means of deepened channels and connecting canals began. The latter were at first limited to boats of small capacity and followed usually the tracks of small natural streams that carried off the surface drainage. About 1845 to 1850 the need was recognized of larger boats, wider channels, and more spacious locks and harbors, and from that period the work of improvement assumed a more comprehensive and broader plan. The map of the Brandenburg system of waterways—submitted as an exhibit with this report—shows 11 separate canals, the most important of which, together with the Teltow Canal, now in construction, will be briefly described.

1. *The Landwehr Canal.*—About 7 miles long and built between 1845 and 1850, is a loop or lateral channel which leaves the Spree at the upper or eastern quarter of Berlin, passes round through the southern portion of the city, and debouches into the river below the city in the suburb of Charlottenburg. It is 100 feet in width, with sloping banks faced with solid masonry, receives no sewage, but has a current of clean water averaging 2 miles an hour. The shores are lined throughout most of the distance with trees, and, the space between the sidewalks and top of the wall being turfed and neatly kept, the canal, which is spanned by numerous handsome stone bridges, is not a blemish, but an ornament to the city. Some of the most beautiful vistas of Berlin are along the curving, densely shaded reaches of the Landwehr Canal. It is used by boats 160 to 180 feet in length, which are either poled or towed by tugs, and bring coal, coke, lime, stone, brick, lumber, and other heavy materials to Berlin or seek, in passing from the Elbe to the Oder or conversely, to avoid the more crowded and difficult channel of the Spree where it passes through the city. This canal has two locks, one at its head, the other near its lower junction with the Spree, and has a minimum low water depth of 8 feet.

2. *The Spandauer and Verbindung canals.*—Still more important as a link in the general system is the Spandauer Canal, built about 1848–1851 to connect the Spree at a central point in the city with

the Havel, in the neighborhood of Spandau. It is about 8 miles in length, and has, besides, several wide basins or pools which serve as harbors for boats and a branch built in 1875 which crosses the suburb of Charlottenburg so as to connect directly with the mouth of the Landwehr Canal above described. Until 1880 the Spandau Canal formed the only practicable outlet westward for boats of large tonnage, but so great had the traffic by this time become that the lower Spree from Berlin to the Havel, parallel to the canal, was canalized and improved as a permanent waterway.

The same necessities compelled at the same time important enlargements and improvements in the Upper Spree to the eastward of Berlin, and the opening of a waterway through to the Oder which would admit the large boats, "Oder Kähne," which are from 180 to 200 feet in length, 28 feet wide, and a capacity of 400 to 660 tons. At that period the upper Spree was connected with the Oder by the old Friedrich Wilhelm Canal at Brieskow, about 50 miles in a direct line eastward from Berlin. From about 1880 this old canal was widened and deepened to meet the new requirements; and

3. *The Oder-Spree Canal*, extended westward, forming a channel, partly canal and partly canalized river—from the Oder to Berlin. The work was completed in 1891 at a cost to the state of 12,700,000 marks ($3,022,600). It opened to Berlin the whole important navigation of the Oder River, which leads down from the remote coal and iron regions of Silesia, past Breslau, Frankfort on the Oder, and Custrin to Stettin, which stands at the head of a long, wide estuary of the Baltic. It gave Berlin not only an all-water downstream route for coal, iron, timber, and building materials from the southeastern frontier of the Empire, but a new and short outlet to the sea, and since the opening of the Kiel ship canal in 1895, much of the British coal used here for gas-making purposes has come to Berlin by the Stettin-Oder-Spree canal route. The opening of this important waterway was followed by such an increase of traffic that within five years a further enlargement was necessary. This was accomplished at a cost of 1,700,000 marks ($404,600) by dredging out the canal at narrow points to a minimum width of 70 feet at the bottom of the channel and securing the banks—which were made steeper by the widening and deepening process—by means of wooden constructions covered with cement slabs. The locks are 200 feet in length by 36 in width, with 9 feet depth of water in the sills—large enough to receive one Oder boat or two of the smaller craft known as "Finow boats" which are 140 feet in length by 16 in width and carry 150 to 200 tons of freight.

Forty miles north of Berlin is the Finow Canal, constructed many years ago and which connect the Oder at Oderburg with the Havel. By this route small boats of the class above described could come from the Oder to Berlin by the long, indirect course via the Havel down to Spandau and thence up the Spandau Canal to the capital, but this route has been of only local importance since the opening of the Spree-Oder system in 1891.

During the period from 1888 to 1893 the state government of Prussia, in cooperation with the municipality of Berlin, made extensive enlargements and improvements of the river, the docks, locks, and harbor facilities within the limits of the city. The Landwehr Canal

had been improved during the preceding five years at a cost of 3,600,000 marks, and the changes which were made in the Spree and its environment cost 11,000,000 marks, a total expenditure by city and state within ten years of $3,474,800. The Spree was lined with perpendicular walls and the sloping banks cut and dredged out so as to give greater dock area and breadth of channel, which has everywhere at the lowest stage of water a minimum depth of 7 feet. Seventy bridges span the river within city limits, all of which have draw spans or, if immovable, a clear space between roadway and water of at least 14 feet.

4. *The Lower Havel.*—To the westward of Berlin there are, as has been shown, two parallel navigable channels—the lower Spree and the Spandauer Canal—which connect the port of Berlin with the Havel at Spandau. Thence the Havel, which is a meandering bayou that broadens at some places to a width of a mile or more, trends southward past Potsdam and thence again westward and northwestward, until its long, irregular channel finally debouches into the Elbe at Havelburg. This is the direct and highly important water route between Berlin and Hamburg. The distance, following the course of the Havel, from Spandau to its junction with the Elbe is 108 miles, of which perhaps half is through a chain of lakes varying from 200 yards to a mile in width. The original channel was originally so shallow in places that vessels drawing more than 3 feet could not pass at a medium stage of water. The navigation was confined to rafts of timber and wide flatboats of light tonnage which transferred through freight to and from the Elbe boats at Havelburg. In 1875 systematic operations were begun to deepen, widen, and otherwise improve the channel so as to enable Elbe boats to come through to Berlin. The work of dredging the shallow places to a depth of 7 feet and a width of 55 meters (187 feet) was begun in 1875 and finished in 1882 at a cost of 3,000,000 marks ($714,000). This was followed soon afterwards by the construction of the Sakrow-Paretzer Canal, between two lakes which form part of the Havel, by which the navigable route is straightened and a long detour cut off to the southwest of Potsdam. This saved a distance of 9 miles, avoided a group of lakes so wide as to be dangerous to navigation in stormy weather, and opened a comparatively straight water route from Potsdam westward to Brandenburg, where the Havel turns northwestward for its long narrow course to its junction with the Elbe. Through this waterway, which forms an important link in the direct water route between Berlin and Hamburg, boats of various sizes, from 180 to 800 tons burden are towed by steam tugs in strings of 2 to 6. In favorable weather single boats often navigate by sail, but are not towed from the shore. This route brought to Berlin in 1900 more than 2,000,000 tons of freight, including 650,000 tons of bituminous coal from Hamburg, brown coal and briquettes from Saxony, and large quantities of agricultural produce. A glance at the map will show that the lower Havel, while offering a quite direct water route to Hamburg and the lower Elbe, makes a long and troublesome detour for boats plying between Berlin and Magdeburg, Schandau, Dresden, or other points on the upper Elbe. To obviate this difficulty

5. *The Plauer Canal* had been built as early as the middle of the eighteenth century, during the reign of Frederick the Great. It runs from the Havel below Brandenburg directly westward to the Elbe, and is 21.6 miles in length. Its termination in the Elbe proved to have been badly chosen, the current at high water making the handling of boats entering the canal difficult and to meet this difficulty as well as to open a valuable district the Ihls Canal, a branch of the Plauer channel 18 miles in length, was built between 1866 and 1871, which by debouching into the Elbe some 20 miles above the mouth of the Plauer, not only secured a favorable entrance for boats but saved that distance in upstream navigation. During the early eighties the capacity of the Ihls and Plauer canals was found inadequate to accommodate the rapidly growing traffic, and they were enlarged to a bottom width of 125 and a depth of 7 feet, at a cost of 3,250,000 marks. An idea of the development of traffic on the Plauer Canal will be gained from the fact that in 1872, 4,546 boats passed by that route, while in 1900 their number had increased to 12,458, carrying 1,231,000 tons of freight.

It remains to cite the most striking proof of the value which, after years of varied experience, is attached to water transportation for heavy freights. As the through traffic between east and west has developed there has arisen a demand for a cut-off or side route which would unite the waterways east and west of Berlin while avoiding the delays and expense incident to passage through the locks and crowded waters of the city. For a number of years the project was agitated as a governmental measure, but failed of adoption, and it has now been undertaken as a local enterprise by the district of Teltow, which includes the wealthy suburban cities of Zehlendorf, Lichterfelde, Steglitz, Schoeneberg, and Rixdorf. This district has undertaken and has now in process of construction:

6. *The Teltow Canal*, which was briefly described in a previous report of this series (Advance Sheets No. 1618, April 11, 1903). This important work is 23 miles in length and will run from the Havel at Potsdam in a northeasterly direction, passing through the suburban cities above named and connecting by two mouths with the Spree above the city. It will thus circumvent the crowded channel of the Spree through Berlin and open up a large tract of land to the south and westward of the city for manufacturing and commercial purposes. Its cost is estimated at 25,500,000 marks ($6,069,000), which has been raised by the sale of 3½ per cent bonds guaranteed by the district government, which sell in the market at 98.60. The Teltow Canal will be adapted to boats of all sizes up to 600 tons burthen, and will be the first canal in Germany to be equipped with an up-to-date equipment for electric towage. It was in view of this installation that the competitive experiments in electric towage were made under government supervision on the Finow Canal during the summer of 1902. The work is now about half completed and will be finished within two years. It will not only embody the most advanced ideas of construction and equipment, but will demonstrate the fact that so modern a city as Berlin, fully provided with steam railways and electric transit facilities, is still obliged to extend and improve her water routes in order to maintain her position as an industrial capital.

*Boats in use on the Elbe-Oder system.*—What is known in German administration as the "Elbe-Oder Gebiet" includes the Oder River from Breslau to its mouth, at Stettin, the Elbe from Schandau, on the Bohemian frontier, down to Hamburg, and the whole network of canals and canalized water courses—the Spree and Havel—which connect the Elbe and Oder through Berlin. In the navigation of this system three general classes of boats are used, viz: (1) The "Elbe boats," 228 feet in length, 28 feet wide, and drawing 6 feet with a full cargo of 660 tons; (2) the "Oder boats," 192 to 200 feet in length, 28 feet wide, and carrying 500 tons, with a draft of 6 feet; and, lastly, the "Finow boats," governed in size by the capacity of the old Finow Canal, 145 feet in length, 16 feet beam, and 225 tons maximum burthen. Besides these classes, which are adapted to both river and canal navigation, there have been built in recent years boats of 800 tons burthen for the navigation of the Oder and up to 1,000 tons, which ply on the Elbe between Hamburg and Magdeburg. These are, however, exceptional. The three standard classes of canal-river boats above described are for the most part towed by steam tugs on the rivers, sometimes drawn by horses or men along certain parts of the canals, and nearly all carry amidships a mast on which a huge square sail is set to catch favoring winds. The mast is stepped in such a manner that it can be lifted out and laid down lengthwise of the boat when a bridge is to be passed or port is reached. Sailing and towage by horses and men are declining as the size of boats increases and speed becomes more important. The day is not far distant when the whole fleet of the Elbe-Oder system will be propelled by electricity and steam.

*Cost of construction and charges upon vessels.*—Until about fifteen years ago canal construction and river improvements throughout Prussia had been undertaken, managed and paid for by the State. At that time the value of inland water transportation routes had become so fully recognized as indispensable to manufacturing districts and the demand for such improvements was so widespread and urgent, that the Government adopted the plan of requiring the communes and districts which demanded them to pay or guarantee the interest of one-third their cost in case the work should upon examination be deemed advisable by the state engineer.

Tolls are collected from boats passing locks throughout the Elbe-Oder system, at the following uniform rates:

For boats laden first class, with valuable cargo, 10 cents per 5 tons register; for boats laden second class, with coarse materials, 5 cents per 5 tons register: for boats without cargo, ¼ cent per 5 tons register.

The lock tolls on a cargo of coal or limestone from Stettin via the Oder and the Spree canals to Berlin, amount to 3 cents per ton on the actual weight of freight.

*Freight rates.*—The cost of freight transportation on the Elbe-Oder waterways varies and fluctuates according to the stage of water, season of the year, and the demands of commerce. Downstream rates are naturally less than those for the same distance upstream. The following table furnished by the Shippers' Association of Hamburg, Lübeck and Stettin, gives the average rates per metric ton on several leading classes of freight from Hamburg upstream to Berlin,

Magdeburg, and Dresden, and from Stettin up the Oder to Berlin and Breslau:

| | Coal. | Stone. | Lumber. | Raw material and fertilizers. |
|---|---|---|---|---|
| Hamburg to— | | | | |
| Berlin | $1.76 | $1.76 | $2.30 | $1.33 |
| Magdeburg | 1.59 | 1.59 | 2.07 | 1.19 |
| Dresden | 2.66 | 2.66 | 3.67 | 1.90 |
| Stettin to— | | | | |
| Berlin | 1.13 | 1.13 | 1.44 | .80 |
| Breslau | 2.19 | 2.19 | 2.64 | 1.58 |

It remains to give some definite idea of the dimensions of the annual canal traffic of Berlin. This is measured by the records of the Wernsdorf and Charlottenburg locks which are passed respectively by boats coming down the Spree and its canals from the Oder, and up from the Elbe through the Havel, the Spandau Canal and the lower Spree. Condensed to their most concrete form the statistics show that in 1900, 32,053 laden boats came to Berlin, bringing 3,771,000 tons of freight, while during the same year 33,327 laden or partly laden boats left Berlin, carrying 1,323,000 tons of merchandise, a total of 65,380 boats and 4,994,000 tons.

FRANK H. MASON, *Consul-General.*

BERLIN, *July 22, 1903.*

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# QUESTIONS FOR CONSULAR OFFICERS IN EUROPE, TO FOLLOW LETTER FROM THE STATE DEPARTMENT.

It is the intention of the members of the National Waterways Commission to visit Europe during the months of August and September for an examination of European waterways, and answers to the subjoined questions will be highly appreciated. It is hoped that the reports may be ready within about thirty days from the receipt of this letter from the commission, so that they may be transmitted to such address as will be hereafter designated. The uncertainty about the date of the adjournment of Congress makes it impossible to state definitely when the visit will be made. It is desired that the reports pertain to the localities in which the respective consuls are located, though, of course, material of a general nature will be useful.

The investigations of the commission will be almost exclusively confined to inland waterways, and no reports upon harbors, save as places for the loading and unloading of river and canal traffic, need be made.

1. How is the expense of improvement provided, both for original construction and for maintenance? Is it by the central government, by the constituent states or subdivisions, by localities immediately affected, or is it by a combination of the three? A statement of total expenditures for the respective improvements, including cost of annual maintenance, would be valuable.
2. Are there tolls or other charges for the use of waterways?
3. Is the amount of water-borne traffic increasing or diminishing?
4. What waterway improvements are under way or in contemplation, and what is the probable cost?
5. What commodities are most carried upon rivers or canals?
6. What are the rates on several specific commodities between localities to be specified, and how do these rates compare with the rates of carriage by rail?
7. What is the prevailing width and depth of waterways and canals?
8. What is the type, size, and draft of boats used? Is the tendency toward the substitution of the barge for the single boat, or the single boat for the barge?
9. What are the methods for the propulsion of boats?
10. What terminals are there for the loading or unloading of freight, and how are the terminals provided?
11. Is there any method for the transfer or interchange of freight between waterways and railways?
12. Is there any utilization of water power in connection with locks or other incidents of navigation?
13. What is the usual annual variation between high and low water, and at what seasons of the year is the water higher or lower?

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# RIVERS OF CHINA, KOREA, AND THE RUSSIAN FAR EAST.

## LETTER FROM HON. WILLARD D. STRAIGHT, CONSUL-GENERAL OF THE UNITED STATES AT MUKDEN, CHINA, INCLOSING MEMORANDUM ON THE NAVIGATION OF THE RIVERS OF CHINA, KOREA, AND THE RUSSIAN FAR EAST.

DEPARTMENT OF STATE,
*Washington, May 3, 1909.*

DEAR SENATOR: I am sending you herewith the memorandum on inland navigation in China and the Russian Far East to which reference has been made in our conversations.

Some of the data contained therein is probably not strictly accurate, as I have been obliged to rely upon my memory in various instances. The portion relating to the Sungari and the northern rivers is based upon personal observations made on a trip taken through northern Manchuria a year ago. Many of the facts, however, were obtained from decennial and annual reports of the Chinese imperial maritime customs service, and from a volume issued by the Jesuit fathers on the geography and physical characteristics of China.

The magazine article to which you suggested I might advert in the accompanying memorandum, seems hardly germane in connection with the part of the world under discussion. You will find it, however, in Everybody's Magazine for April, it being entitled "Making rivers work," by John L. Matthews.

I am leaving to-night for the Far West and expect to be back in Washington again by the middle of June, at which time I hope I may have the pleasure of seeing you.

Trusting that you will find the accompanying memorandum of interest, believe me,

Yours, very truly, WILLARD D. STRAIGHT.

Hon. THEODORE E. BURTON,
*United States Senate.*

## A MEMORANDUM ON THE NAVIGATION OF THE RIVERS OF CHINA, KOREA, AND THE RUSSIAN FAR EAST.

For centuries the bulk of China's domestic trade has been borne on the broad streams and connecting canals of that Empire.

With the advent of the foreigner, steam craft have each year carried an increasing proportion of river freight. Fleets of lorchas and

junks of all sizes, however, are still used for shipping nonperishable cargo and goods in the transport of which time is of little importance.

Sources of wealth, these rivers have also during the course of centuries caused great suffering when in years of drought they failed to give their usual aid to the farmers, and tremendous loss of life when torrential rains scouring down the bare hillsides have swept away villages and cities in their roaring floods.

Efforts have long been made to regulate the flow of the Yellow and other rivers which time and again have broken through their illy built dikes, and carried death and destruction throughout the country. The Chinese, in addition to their attempt at river conservancy, have in times past built splendid canals, the greatest of which from Peking to the Yangtze though in sad disrepair, still bears an inifinitesimal portion of its former traffic, while the trade between Shanghai, Suchow, and Hangchow, and the other rich cities of Kiangsu and Kiangsi is carried through a network of small rivers and artificial waterways.

*Conservancy.*—The Chinese imperial maritime customs now maintains light-houses and buoys on the Yangtze as far upstream as Ichang, and on the West River as well as on the Chinese coast. Conservancy work is a recent development, the greatest strides in which have been made in the Peiho, between Tientsin and the river mouth, while the Shanghai project has but lately passed beyond the shadow of diplomatic negotiations.

Plans for the conservancy of the Liao at Newchwang and the Yalu at Antung have also been discussed.

*Navigation regulations.*—Beside the steamers of various sizes which ply between river treaty ports under the regular customs and the special so-called "Yangtze" regulations numerous smaller craft trade between treaty ports and unopened cities under the "Inland waters steam navigation rules." The latter craft are principally used for native passenger traffic on short runs or in towing junks through the canals and small streams.

*Pilots.*—The difficulties of navigation on the West River, the Yangtze, the Peiho, and the Yalu, as well as on the rivers of the Russian Far East, give employment to a large number of foreigners, who by long experience are familiar with the vagaries of the streams with which they have to deal.

*Labor.*—Cheap native labor, coolies receiving rarely more than 25 cents per day, has rendered unnecessary what would be the great expense of erecting modern equipment for handling cargo at the various ports along these rivers.

*Fuel.*—All steam craft on the rivers of China and Korea use coal. The Russian vessels plying on the Sungari and the Amur system burn wood.

*Railroad connections.*—Railroads have only recently appeared as a factor in the inland trade of the East. The relation present and probable between these lines and the inland waterways may be seen on the accompanying map.

The Yangtze is now paralleled by the British road between Wusung, Shanghai, and Nanking, a line which will ultimately from a point opposite Nanking be extended to Hsinyang on the main route between Peking and Hankow. From Hankow the French hope to build a road to Ichang.

A portion of the West River traffic will also be rail borne upon the completion of the Canton-Kowloon Railway.

The Peking-Hankow line is now a feeder for Yangtze carriers, and the proposed Canton-Hankow, Suchow-Hangchow-Ningpo, Chengtu-Hankow, and Yunnan-Chungking roads will become so when constructed.

The Chinese Eastern Railway is at present worked in connection with the company's steamships on the Sungari, Amur, and northern rivers. There will eventually be a line running practically parallel with the Amur from Stretensk to Habarovsk.

At Harbin and Habarovsk railway sidings run along the water's edge.

*Likin.*—No discussion of this subject would be complete without reference to Likin, the levies collected along the land and water highways of the interior of China which hamper native and foreign trade alike.

It is difficult to estimate the exact amount of such taxation. The annoyance and delay caused by frequent inspections by the tax collector and the difficulties placed in the way of those who, having met the regular customs requirements, attempt to send their goods through without further payment, constitute the principal causes for complaint.

## THE YANGTZE.

*Character of stream.*—The most important river in China is the Yangtze, which drains an area of 700,000 square miles with 200,000,000 inhabitants, and flows 3,200 miles through the center of the Empire into the Eastern China Sea near Shanghai, serving as the principal inland waterway and avenue of distribution for this vast region. Except in its estuary, where the stream widens to twenty miles and over, there is little variation in the width of the river as far as Hankow, 630 miles from the sea, it being uniformly between 1½ and 1 mile wide. Between Hankow and Ichang, 370 miles, the stream is much more narrow, and between that point and Chungking, 400 miles, the rapids make navigation for even small steamers practically impossible.

The mean flow of water has been roughly estimated at 3,530,000 cubic feet.

At Chungking the river bed is 600 feet above the sea. At Ichang only 130. In the upper reaches there is sometimes a difference of 96 feet between high and low water; in the lower Yangtze, however, there is rarely more than a 30-foot variation.

During the greater part of the year no difficulty is experienced in navigating the Yangtze as far as Hankow, the river being generally from 30 to 60 feet deep, vessels drawing 25 feet being able to reach Hankow during the summer. Low water generally causes trouble only near Kiukiang and Chinkiang. The current at Hankow, where the Han River joins the main stream, varies between 3 and 4 knots per hour. Up river it is more rapid, but below Kiukiang it seldom reaches more than 2 knots.

*Yangtze treaty ports.*—There are five treaty ports—places where foreigners may reside and trade—above Hankow, namely, Chungking, Ichang, Shasi, Yochow, and Changsha. Of these places Changsha and Yochow are on the Tungting Lake, the former acces-

sible only to small steamers and their light-draft tows. Between Hankow and Shanghai are four ports, Kiukiang, Wuhu, Nanking, and Chinkiang, the latter at the entrance of the Grand Canal. In addition there are certain "ports of call," where steamers are permitted by special regulation to discharge and load cargo and passengers.

A network of canals navigable for small launches and light-draft native vessels connects Shanghai with Hangchow and Suchow, both of which cities are open to international trade.

*Steamship lines.*—At the present time the principal steamship lines plying on the Yangtze are the two British—i. e., Jardine Matheson & Co. and Butterfield & Swire—the China Merchants Company, and the German,[a] French, and Japanese[a] lines.

In the old days river steamers were modeled on American lines; both side and stern wheels were used. Modern vessels fitted for passengers and freight are now in almost every case supplied with screws. Those plying between Hankow and Shanghai sometimes carry up to 4,000 tons, the average size varying, however, from 2,000 to 2,500 registered tonnage, running from 9 to 12 knots an hour.

The craft on the upper reaches of the river between Hankow and Ichang do not average over 1,000 registered tonnage. In the winter it is not possible for vessels drawing more than 6½ feet to navigate this portion of the stream. But two steamers have reached Chungking since 1898, one in that year and one in 1900.

The voyage from Shanghai to Hankow requires three days; from Hankow to Ichang, four; and the up-river trip to Chungking anywhere from thirty to forty days.

Ocean-going steamers, seldom exceeding 6,000 tons, have gone upstream as far as Hankow, there loading tea, hides, etc. Vessels engaged in the coastwise traffic, of 4,500 tons, visit Wuhu, Chinkiang, and Hankow. Some difficulty is experienced, however, in handling such craft, particularly at Chinkiang, on account of their length.

At all Yangtze ports vessels moor to hulks connected with the shore by wooden bridges, which adjust themselves with the rise and fall of the river, or else anchor in the stream, their cargoes being handled by lighters. At Shanghai, however, the river is bunded and vessels are tied up at well-constructed wharves.

*The port of Shanghai.*—It is at the present time generally impossible for vessels of over 6,000 tons to ascend the Whangpu to Shanghai. There is usually about 16 feet of water on the outer bar, depths on the inner varying between 11 and 14 feet. Large craft therefore are compelled to lie off Wusung, at the mouth of the Whangpu River; their cargoes are brought to Shanghai on lighters at considerable expense, an outlay which, it is hoped, will not be necessary when the conservancy work at present projected is completed.

## THE PEIHO.

The city of Tientsin is located on the Peiho River about 25 miles from its mouth. The river is narrow, seldom more than one-quarter of a mile wide, and at Tientsin itself not more than 300 yards broad, and it is closed by ice generally from mid-December to early March.

[a] These lines are subsidized, the Japanese receiving very considerable assistance from the Tokyo Government.

Save a few junks, there is no river traffic as such, the stream being used by coastwise steamers plying between Tientsin, Shanghai, Newchwang, etc.

At Tientsin there are 2 miles of wharfage. Large vessels, which on account of their size are unable to cross the Taku bar, are obliged to discharge their cargoes off Tongku and send them upstream by lighter.

Conservancy work during the past three years, however, has greatly bettered conditions. Numerous cut-offs have been made, the course of the river straightened, and the channel deepened, so that it is now possible for vessels drawing upward of 16 to 18 feet to reach Tientsin. These steamers are generally registered at between two and four thousand tons.

Tientsin has a population of 800,000, and its whole trade for 1907 was valued at 96,778,966 haikwan taels.[a]

During 1907, 1,710 steamers, with a tonnage of 2,188,074, and 292 vessels plying under the "Inland navigation rules," with a tonnage of 57,935, entered and cleared from Tientsin.

### WEST RIVER.

The stream next in importance after the Yangtze is the West River, which, with its affluents, the Peikiang, Kueikiang, Liukiang, and Yukiang, carries considerable traffic between Canton, Samshui, Wuchow, and Nanning, treaty ports, and other cities not yet opened to foreign residence and trade. Located on the arm of the sea into which the West River flows is Hongkong, the great emporium for South China. Here for the sake of convenience is located the so-called "Kowloon" office of the Chinese imperial maritime customs, which, like the Lappa office located at the Portuguese colony at Maçau, deals with a large trade borne by launches, junks, and small steamers through a network of canals to various points in the West River Delta.

The steamers plying the West River between Hongkong, Canton, and Wuchow are much the same though smaller than those used on the Yangtze. The methods of handling cargo are practically identical.

### THE YALU RIVER.

The Yalu is the boundary stream between Manchuria and Korea, and bears, summer and winter, the principal trade of this region. Antung, 20 miles upstream, is the principal city on the Yalu, and, like Tatungkow at the river mouth, owes its existence primarily to the timber trade and the business resulting therefrom. There is but little traffic on the river above Antung; the current is too strong for junks and the stream too shallow for steamers. Population, moreover, is sparse, and the trade with up-river towns is much more easily carried on over the ice which closes the Yalu from mid December until mid March. During the open season great timber rafts are floated down from the forests, distant from 300 to 400 miles.

Wiju is the largest city in northern Korea, but has little commercial importance. Opposite Antung is New Wiju, the northern ter-

[a] The haikwan tael is equivalent to about $0.75.

minus of the railway line running through the peninsula from Fusan. At this place are Japanese sawmills, railway shops, etc., but the business of the Yalu is done on the other side.

Seventeen miles downstream on the Korean side is Yongampo, where also are located Japanese sawmills.

The river at Antung is three-quarters of a mile wide, and at Yongampo about 1¼. The tide between Antung and the river mouth, together with the current, gives a velocity sometimes of from 5 to 8 knots an hour, while there is an average neap rise of 6 and a spring rise of 9 feet. Vessels of 8 to 9 feet draft will generally reach Antung without difficulty; larger craft are forced to unload to lighters at the river mouth.

Like Tientsin, Antung is a sea rather than a river port, and the vessels entering and clearing from this place are coasting vessels generally of not more than 1,000 tons burden.

The population of Antung is given at 22,000 Chinese and 5,000 Japanese. Tatungkow has about 5,000; Wiju, 6,000; New Wiju, 6,000; Yongampo, 1,500 inhabitants.

The total trade of Antung for 1907 was valued at 4,763,238 haikwan taels; that of Tatungkow at 66,515 haikwan taels.[a]

### OTHER CHINESE RIVERS.

Navigation on other Chinese rivers, i. e., the Yellow, Han, and various tributaries of the Yangtze, and the Liao, etc., is confined to native craft, handled in a primitive manner. These streams, therefore, will not be considered in this memorandum.

### KOREAN RIVERS.

The principal Korean rivers are the Anju and Taidong, both flowing into the sea on the northwest coast of the peninsula. The former, although a large river, is scarcely to be considered a navigable stream. The Taidong River at the mouth of which is the treaty port Chinnampo, is navigable for junks for some 65 miles. Small coasting craft of from 200 to 1,000 tons burden are able to go upstream as far as Mamkyendie, 12 miles from Pingyang, the second largest city in Korea. There is 6 feet of water off that town. The current and tide are swift, and navigation above Chinnampo, although it has possibilities for the future, is yet undeveloped.

## RIVERS OF NORTHERN MANCHURIA AND THE RUSSIAN FAR EAST.

### THE SUNGARI.

The Sungari, the principal stream in northern Manchuria, is navigable for small steamers as far as Kirin, the capital of the province of that name. The 255 miles of upper stretch of the river between this city and Harbin varies in width from about 250 yards at the former to three-quarters of a mile at the latter place, and flows through a generally flat country. The current for some distance

[a] The haikwan tael is equivalent to about $0.75.

below Kirin, where the river cuts through the hills, however, is rapid, running as much as 3 to 5 miles an hour. The river is closed by ice from November until March.

The principal town between Kirin and Harbin is Petuna, where the Nonni, bearing an inconsiderable junk traffic from Tsitsihar, a city of 30,000 inhabitants, joins the Sungari. On the upper Sungari there are a few small steamers belonging to the Chinese Eastern Railway Company. These craft themselves carry few passengers and no cargo, but tow light draft barges which bear perhaps a hundred to one hundred and fifty tons of freight with about thirty passengers.

The Chinese have up to the present time made practically no attempt to foster navigation on this stream. A few junks and a few rafts constitute their river shipping.

The real trade on these northern waterways, which embrace the 450 miles of the Sungari below Harbin, the 2,050 miles stretch of the Shilka and Amur between Stretensk and Nicolaievsk, the Argun, which, joining with the Shilka between Stretensk and Blagovestchensk, forms the Amur, the Zeya, which joins the Amur at the last named place, and the Ussuri, which flows into the Amur at Habarovsk, is therefore in the hands of the Russians. They have charted the channels of these rivers, and on the banks have erected beacons and guide posts which on the Sungari facilitate navigation by day and on the Amur permit travel both by day and night. Along the Sungari cossack guards are still stationed and small gunboats police the stream. There is a flotilla of light-draft war vessels on the Amur and a regular government department has charge of the lights, buoys, and dredges on the river. Fuel stations with great stacks of firewood are maintained at intervals along the banks, with the result that a naturally well-timbered country has for some miles back from the stream now been nearly denuded from trees.

*Lower Sungari.*—The Sungari between Harbin, a city of 80,000 inhabitants, and its juncture with the Amur at Lahasusu, varies from three-quarters of a mile to 1¼ miles in width. The greater part of this course is through flat, uninteresting country. River banks are constantly crumbling away and the channel shifts from month to month. It is rarely, however, less than from 6 to 8 feet deep, with the exception of one shoal above Sansing, where there is not more than 3 feet of water during the dry season. The current does not exceed 2 knots an hour. There is but one treaty port, Sansing, a town of about 16,000 inhabitants, between Harbin and the mouth of the Sungari.

### THE AMUR.

The Amur between Blagovestchensk and Habarovsk is generally about 1 mile in width, with the exception of the stretch where the stream runs through the Khingan Mountains. In these reaches the current is swift; in the wider portions, however, it averages not more than 2 to 3 knots an hour.

The channel is generally from 8 to 12 feet deep, and a quick descent of the beach enables vessels to moor at the banks and discharge passengers and cargo over the gang planks which rest on the shore.

At all the principal towns near the steamship landings, or rather the points at which they usually tie up to the banks, are bulletin boards, which furnish navigators with information regarding the river depths at various points along the stream.

From Stretensk steamers follow the Shilka to the point where on its juncture with the Argun it forms the Amur. From Stretensk to Blagovestchensk is a distance of 823 miles, the journey requiring about five days. From Blagovestchensk a city of about 40,000 inhabitants, to Habarovsk, a somewhat smaller town, the distance is 605 miles, and 650 miles thence to Nicolaievsk at the mouth of the Amur.

Between these four cities are scattered the villages and towns of the Amur cossacks. Agriculture does not apparently appeal to the inhabitants, and they seem to exist principally by selling wood to the passing steamers, and milk, butter, and cheese to the passengers thereon.

There are about 200 Russian steamers with 400 barges engaged in this river traffic. Most of the former are fitted with stern wheels, some with side wheels, but none with screws. They vary in size. The average vessel carries about 500 tons, between 100 and 150 passengers of all classes, and draws about 5 feet when loaded. The barges draw about 4 feet of water and carry about 1,000 tons. The largest craft on the river is a steamer of 1,500 tons, which has been completed recently and will carry about 250 passengers.

These rivers are ice free during certain portions of the year only, as follows:

The Sungari, from Harbin to Habarovsk, from March to November.

The Amur, from Blagovestchensk to Habarovsk, from the middle of April to the middle of October, and between Stretensk and Habarovsk and Nicolaievsk from the middle of May until the beginning of October.

The Zeya and the Argun are navigable during this same period, while the Ussuri is free from ice from March to November.

THE YANGTZE PORTS.

| | Population. | Distance from Shanghai. | Value of trade, 1907. |
|---|---|---|---|
| | | *Miles.* | *Haikwan taels.*[a] |
| Chungking | 705,000 | ..... | 27,045,904 |
| Ichang | 55,000 | 970 | 6,557,173 |
| Shasi | 85,000 | ..... | 1,880,422 |
| Changsha | 230,000 | ..... | 7,292,133 |
| Yochow | 20,000 | ..... | 1,854,155 |
| Hankow | 778,000 | 600 | 115,071,383 |
| Kiukiang | 36,000 | 458 | 30,337,377 |
| Wuhu | 122,000 | 264 | 21,390,455 |
| Nanking | 267,000 | 212 | 10,415,071 |
| Chinkiang | 181,000 | 165 | 32,437,296 |
| Shanghai | 651,000 | ..... | 137,058,289 |
| Soochow | 500,000 | ..... | 4,367,546 |
| Hangchow | 350,000 | ..... | 19,687,735 |

[a] The haikwau tael equals $0.75.

THE YANGTZE PORTS—Continued.

| | Entries and clearances, 1907. | | |
|---|---|---|---|
| | Character of vessels, etc. | Number. | Tonnage. |
| Chungking | Sailing vessels | 2,281 | 68,659 |
| Ichang | Steamers | 404 | 388,583 |
| | Sailing vessels | 4,913 | 526,350 |
| Shasi | Steamers | 786 | 770,316 |
| Changsha | do | 737 | 304,254 |
| | Sailing vessels | 29 | 441 |
| | Inland navigation | 3,576 | 314,989 |
| Yochow | Steamers | 2,445 | 1,415,095 |
| | Sailing vessels | 1,063 | 27,811 |
| | Inland navigation | 125 | 35,948 |
| Hankow | Steamers | 3,663 | 4,349,023 |
| | Sailing vessels | 2,673 | 227,497 |
| | Inland navigation | 3,854 | 96,776 |
| Kiukiang | Steamers | 3,634 | 5,915,178 |
| | Sailing vessels | 172 | 34,006 |
| | Inland navigation | 1,903 | 188,705 |
| Wuhu | Steamers | 3,821 | 6,118,571 |
| | Sailing vessels | 405 | 52,827 |
| | Inland navigation | 2,610 | 48,410 |
| Nanking | Steamers | 4,838 | 5,206,067 |
| | Sailing vessels | 348 | 39,536 |
| | Inland navigation | 1,266 | 25,319 |
| Chinkiang | Steamers | 6,209 | 6,588,165 |
| | Sailing vessels | 1,634 | 243,930 |
| | Inland navigation | 7,214 | 138,098 |
| Shanghai | Steamers | 15,936 | 16,487,946 |
| | Sailing vessels | 36,768 | 1,057,577 |
| | Inland navigation | 6,300 | 91,452 |
| Soochow | Steam launches and junks, sailing vessels | 5,746 | 312,448 |
| | Inland navigation | 2,776 | 73,844 |
| Hangchow | Steam launches, tows, and sailing vessels | 11,252 | 578,617 |
| | Inland navigation | 1,013 | 18,214 |

THE YALU PORTS.

| | Entries and clearances, 1907. | | |
|---|---|---|---|
| | Character of vessels, etc. | Number. | Tonnage. |
| Antung | Steamers | 422 | 151,232 |
| | Sailing vessels | 517 | 154,657 |
| | Inland navigation | 2 | 1,036 |
| New Wiju | Steamers | 107 | 94,859 |
| | Sailing vessels | 108 | 94,977 |
| Tatungkow | Steamers | 32 | 10,548 |
| | Sailing vessels | 34 | 10,588 |
| | Inland navigation | 20 | 5,116 |

WEST RIVER PORTS.

| | Population. | Distance from Canton. | Value of trade. |
|---|---|---|---|
| | | *Miles.* | *Haikwan tael.* |
| Canton | 900,000 | | 103,782,947 |
| Samshui | 6,000 | 163 | 3,945,891 |
| Wuchow | 59,000 | 283 | 9,663,395 |
| Nanning | 40,000 | 513 | 1,554,600 |
| Kowloon (Hongkong) | | 90 | 54,381,058 |
| Lappa (Macau) | | 80 | 17,108,785 |

WEST RIVER PORTS—Continued.

| | Entries and clearances. | | |
|---|---|---|---|
| | Character of vessels, etc. | Number. | Tonnage. |
| Canton | Steamers | 7,535 | 4,656,921 |
| | Sailing vessels | 397 | 81,643 |
| | Inland navigation | 46,563 | 648,519 |
| Kowloon | Launches | 5,973 | |
| | Junks | 35,371 | |
| | Inland navigation | 1,106 | 26,980 |
| Lappa | Launches | 3,606 | |
| | Junks | 12,218 | |
| | Inland navigation | 3,606 | 98,825 |
| Samshui | Steamers | 3,264 | 910,206 |
| | Sailing vessels | 108 | 23,394 |
| | Inland navigation | 8,008 | 169,064 |
| Wuchow | Steamers | 1,530 | 435,764 |
| | Sailing vessels | 277 | 4,512 |
| | Inland navigation | 2,490 | 51,094 |
| Nanning | Steamers | 50 | 2,412 |
| | Sailing vessels | 179 | 4,998 |
| | Inland navigation | 84 | 1,042 |

THE SUNGARI BELOW KIRIN.

THE LOWER SUNGARI. A MAN IN THE BOW MAKES CONSTANT SOUNDINGS.

RUSSIAN WOOD STATION ON SUNGARI, WHERE CHINESE EASTERN RAILWAY CROSSES RIVER.

NATIVE JUNKS ON THE NONNI AT TSI TSI HAR.

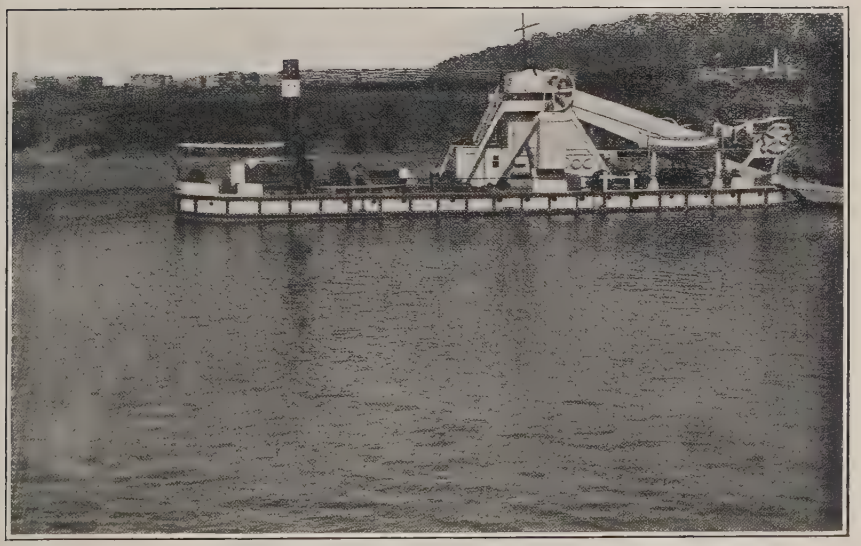
RUSSIAN POST BOAT ON THE AMUR.

ALL FREIGHT IS BROUGHT ASHORE ON THESE GANG PLANKS.

THE SUNGARI AT HARBIN.

THE SUNGARI AT KIRIN.

RUSSIAN STEAMER ON THE AMUR.



RUSSIAN GOVERNMENT DREDGE ON THE AMUR.

CATTLE BARGES ON THE SUNGARI.

RUSSIAN TRAMP STEAMER ON LOWER SUNGARI.

LUMBER RAFTS ON THE SUNGARI AT KIRIN.

# RAILWAYS IN CHINA AND MANCHURIA.

## LINES CONSTRUCTED.

With Chinese Capital
" Belgian "
" German "
" British "
" Russian "
" Japanese "

## LINES CONSTRUCTING.

With British Capital.
" Belgian "
" French "
" Russian "

## LINES PROJECTED.

With British Capital.
" German "
" Belgian "
" Japanese "
" Chinese "

Other lines outside Chinese Empire.

Amur R.
Stretensk
Zeya R.
Blagoveschensk
Khorbarovsk
Manchuria
Nonni R.
Amur R.
Tsitsihar
Sungari R.
Sausing
Ussuri R.
Harbin
Petuna
Kirin
VLADIVOSTOCK
Hsinminting
MUDKEN
YAHU R.
Antung
Anju
TAITONG R.
Newchwang
PEKING
Pingyang
Dalny
PORT ARTHUR
Chinnampo
Tientsin
Chefoo
Kiaochau
Chinan
Huang Ho R.
Yellow R.
Hsian.
GRAND CANAL
Chinkiang
Nanking
Soochow
Wuhu
Chengtu
Wanhsien
Ichang
HANKOW
Yangtze R.
Hanagchow
Ningpo
Shasi
Chungking
Tungting L.
Yochow
Kiukiang
Changsha
Wenchow
Santuao
Foochow
Amoy
Yunnan
West R.
Mengtze
Szemao
Samshui
CANTON
Swatow
Nanning
Wuchow
Kowloon
HONGKONG
Lungchow
Lappa
Kongmoon
Pakhoi

# THE DELAWARE AND RARITAN CANAL.

## STATEMENT OF THE EXPENSES, NET EARNINGS, EXCESS OF EXPENSES, TONS, AND TONS 1 MILE OF THE DELAWARE AND RARITAN CANAL FOR THE YEARS 1872 TO 1910, INCLUSIVE, SUBMITTED BY MR. JAMES McCREA, PRESIDENT OF THE PENNSYLVANIA RAILROAD CO.

| Year. | Earnings. | Expenses. | Net earnings. | Excess of expenses. | Tons. | Tons 1 mile. |
|---|---|---|---|---|---|---|
| 1872 | $1,524,605.24 | $1,016,037.49 | $508,567.75 | | 2,837,532 | |
| 1873 | 1,590,100.12 | 883,321.46 | 706,778.66 | | 2,754,837 | |
| 1874 | 1,320,519.23 | 768,416.64 | 552,102.59 | | 2,308,671 | |
| 1875 | 1,067,660.58 | 541,035.76 | 526,624.82 | | 1,958,004 | |
| 1876 | 882,551.78 | 523,306.02 | 359,245.76 | | 1,897,708 | |
| 1877 | 896,569.65 | 477,606.78 | 418,962.87 | | 2,023,443 | 93,800,450 |
| 1878 | 702,083.45 | 389,720.25 | 312,363.20 | | 1,524,530 | 63,477,228 |
| 1879 | 695,959.10 | 326,924.85 | 369,034.25 | | 2,103,510 | 86,552,368 |
| 1880 | 419,430.57 | 331,343.53 | 88,087.04 | | 1,348,082 | 53,508,532 |
| 1881 | 541,076.73 | 232,314.17 | 308,762.56 | | 1,710,888 | 68,981,905 |
| 1882 | 553,417.70 | 294,780.13 | 258,637.57 | | 1,659,044 | 65,434,961 |
| 1883 | 548,055.21 | 291,574.56 | 256,480.65 | | 1,694,884 | 66,632,686 |
| 1884 | 547,710.66 | 381,403.87 | 166,306.79 | | 1,473,973 | 57,412,933 |
| 1885 | 529,079.06 | 342,373.94 | 186,705.12 | | 1,398,715 | 54,618,568 |
| 1886 | 533,525.99 | 390,705.41 | 142,820.58 | | 1,287,828 | 50,521,774 |
| 1887 | 494,218.72 | 414,158.81 | 80,059.91 | | 1,182,488 | 46,087,185 |
| 1888 | 525,748.92 | 430,680.31 | 95,068.61 | | 1,386,981 | 54,356,440 |
| 1889 | 518,907.93 | 418,940.19 | 99,967.74 | | 1,276,269 | 49,259,959 |
| 1890 | 509,162.76 | 415,326.08 | 93,836.68 | | 1,209,668 | 47,190,467 |
| 1891 | 400,174.18 | 363,224.80 | 36,949.38 | | 1,001,056 | 37,873,833 |
| 1892 | 359,307.44 | 358,336.90 | 970.54 | | 794,589 | 30,587,792 |
| 1893 | 317,141.28 | 331,470.89 | | $14,329.61 | 757,670 | 26,257,355 |
| 1894 | 287,640.73 | 300,322.91 | | 12,682.18 | 705,425 | 24,366,610 |
| 1895 | 274,438.24 | 308,865.36 | | 34,427.12 | 661,148 | 20,874,942 |
| 1896 | 260,882.07 | 292,844.73 | | 31,962.66 | 644,516 | 20,040,639 |
| 1897 | 237,298.61 | 275,270.25 | | 37,971.64 | 634,809 | 20,464,309 |
| 1898 | 259,141.56 | 297,719.86 | | 38,578.30 | 581,058 | 19,358,863 |
| 1899 | 285,068.21 | 343,501.23 | | 58,433.02 | 645,811 | 20,436,111 |
| 1900 | 296,871.06 | 331,805.16 | | 34,934.10 | 623,751 | 19,986,584 |
| 1901 | 272,752.63 | 331,649.03 | | 58,896.40 | 547,453 | 17,274,025 |
| 1902 | 334,066.46 | 384,767.76 | | 50,701.30 | 510,316 | 16,066,301 |
| 1903 | 293,962.89 | 406,275.94 | | 112,313.05 | 448,727 | 11,438,531 |
| 1904 | 275,266.95 | 378,484.90 | | 103,217.95 | 491,388 | 12,770,618 |
| 1905 | 298,937.86 | 413,382.75 | | 114,444.89 | 470,416 | 10,685,913 |
| 1906 | 308,500.96 | 432,386.71 | | 124,085.75 | 424,986 | 10,031,259 |
| 1907 | 362,801.37 | 480,509.47 | | 117,708.10 | 417,034 | 9,330,411 |
| 1908 | 277,818.88 | 439,181.87 | | 161,362.99 | 397,258 | 7,839,267 |
| 1909 | 272,619.66 | 398,613.58 | | 125,993.92 | 401,231 | 7,396,368 |
| 1910 | 302,981.34 | 428,070.41 | | 125,089.07 | 448,964 | 8,470,802 |
| Total | 20,377,855.78 | 16,166,654.76 | 4,462,284.01 | | | |

This canal was completed about 1838 at an estimated cost of $2,500,000. Up to 1906 $5,113,749 was spent for construction and improvement. The canal proper extends from Bordentown, N. J., to New Brunswick, a distance of 44 miles. A feeder 22 miles in length unites Raven Rock, N. J., with Trenton. The canal was leased to the Pennsylvania Railroad Co. in 1871 for 999 years.

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# THE PORT OF HAMBURG AND THE LOWER ELBE.

## LETTER

FROM

**THE CHIEF OF ENGINEERS, U. S. ARMY, INCLOSING REPORT OF MAJ. F. A. MAHAN, CORPS OF ENGINEERS, U. S. ARMY, RETIRED.**

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, December 11, 1903.*

Hon. T. E. BURTON,
*Chairman Committee on Rivers and Harbors,*
*House of Representatives.*

DEAR SIR: I have the honor to transmit herewith a letter from Maj. F. A. Mahan, Corps of Engineers (retired), addressed to me, inclosing a report upon the port of Hamburg and the lower Elbe, and a map of the port of Hamburg.

If you do not wish to retain these papers, I would be very glad to have them, at your convenience, for the files of this office.

Very truly, yours,

G. L. GILLESPIE,
*Brigadier General, Chief of Engineers, U. S. Army.*

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51 AVENUE MONTAIGUE,
*Paris, France, November 27, 1903.*

Brig. Gen. G. L. GILLESPIE,
*Chief of Engineers, U. S. Army, Washington, D. C.*

GENERAL: Having waited now for nearly three weeks for the information about which I wrote to Hamburg, in order to complete my report on that seaport, I have concluded to wait no longer. Consequently, I am sending by to-day's mail, in a separate package (registered), the work so far done. I will send as a supplement the further data so soon as these shall have been received.

In the report there are a few words about which I am not sure. The German word, written in pencil, occupies the place where the English word should be. There are but four of these words in all; two, "Krahnhöft" and "Schwergut," on page —, and two, "Priel" and "Haubt," on page —. Höft I take to mean a pointed head of a

wharf or quay; Krahnhöft then means the pointed pierhead, on which stand the big derricks, between the Moldauhafen and the Segelschiffhafen.

I can find nothing for the other words. I judge by the context that Priel is a sort of meadow, and that Haubt is a corruption of Haupt, meaning "head," and that it means here a pierhead. These words are among the items of information for which I have written.

The map [a] inclosed with the report gives the whole port in which ocean traffic is interested. It will be noticed that the water surface is tinted with two shades of blue; the lighter shade lies within the free port. The green line which surrounds it is the customs frontier.

Far more attention has been given to the details of this port than will be given to any of the other ports visited, except, possibly, Bremen. Hamburg is an autonomous state with a present population of about 800,000 souls in round numbers. This small population has built up this port, the most important of the Continent of Europe, by its unaided efforts. It is an example of what a few persons, well directed, can accomplish when there is kept constantly in view a clearly defined end. Bremen, less important than Hamburg, is also an autonomous state which, by the same unflinching enterprise and perseverance, has accomplished a great work.

The report on the Rhine is far advanced. As the river with the most intense traffic of Europe and probably of the world, it is well worth the detailed study which I am giving to it and to its ports, marvelous examples of how trade follows facilities. This report will certainly be much more than double the one I am sending on Hamburg.

Very respectfully, your obedient servant,

F. A. Mahan,
*Major of Engineers, Retired.*

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## THE PORT OF HAMBURG AND THE LOWER ELBE.

While a historical sketch of any seaport may be out of place in a technical report, the presentation of such a sketch may be justified in the case of a city which has been for centuries a seaport of importance, and which is to-day, beyond question, the greatest of continental Europe, and one of the greatest in the world.

Hamburg was in all probability an important fortified post on the north side of the Elbe when the Emperor Charles the Great, having overcome the Saxons and conquered the whole country south of that river, founded here a city as a protection against the Slavs and other northern tribes. He built in 811 a church which became the center of the spread of Christianity not only for North Albingia and the whole Cymbrian peninsula, but also for the Danish islands and even for Sweden and Norway. This oldest Hamburg did not stand on the banks of the Elbe, whose shores were as yet an undiked, swampy wilderness, but on the projecting points of the wooded high grounds of the "Geest," which were above water, on the left bank of the

[a] Map referred to is not printed with this document.

Alster, a tributary, somewhat west of where the city hall and exchange now mark the center of the city.

Hamburg was repeatedly conquered and sacked by the Normans, Slavs, Wends, and others, but it was always reconquered and steadily rebuilt. This, more than anything else, testifies to the importance of the place. The immigration of colonists, almost exclusively from the south, kept up, and so from the very beginning it developed as a true German city. Ludwig the Brave raised Hamburg to the rank of an archbishopric, and St. Ansgarius was the first archbishop. The seat of the archbishop was removed temporarily to Bremen as a consequence of the repeated sackings of Hamburg, yet the archiepiscopal dignity and honor remained always at the latter place, until 1223, when the archiepiscopal seat was removed definitely to Bremen.

The old Hamburg was administered by the imperial prefects, of whom Hermann Billung, one of the ancestors of the Guelphs, had been in Hamburg since 957. He is pointed to as the founder of the commonwealth of Hamburg. The counts of Schauenburg came by enfeoffment into possession of Holstein and Hamburg in 1111, and under these admirable princes Hamburg saw its first period of splendor. Fishing was the original business of the inhabitants; in it was laid the foundation for the later developed navigation, which received its first impulse under the Schauenburg sway. St. Peter's Church, dedicated to the patron saint of fishermen, was founded at this time. The Alster, in which the tide rose and fell freely, was closed by a dam; the adjacent marshes of the Elbe were diked in and made productive by Dutch and Frisian immigrants. The Alster was closed a second time, about a hundred years later (1245), by a mill dam which serves to-day as the foundation for the street known as the Jungfernstieg. In 1188 Adolf III presented the Neueburg, which he had used as a residence, for a chapel dedicated to St. Nicolas, the patron saint of seafarers. The inhabitants engaged in navigation settled on the diked-in lower part of the Alster, near this chapel, which stood not far from the site of the present St. Nicolas Church.

Hamburg received, in 1189, from the Emperor Frederic Barbarossa a free letter, in which among other favors (such as municipality and jurisdiction) it was granted: that the citizens of Hamburg "should carry on business with vessels, goods, and persons from the sea to the city and reverse free from all duties and tribute," and that they should have the right to fish in the Elbe from the city to the sea. This imperial privilege, dated May 7, 1189, was obtained by Count Adolf III von Schauenburg for his city of Hamburg, which, in consideration of this privilege, was to give to the count a stated contribution for the crusade which Barbarossa was contemplating and for which the count had promised his aid. This free letter has been for centuries a protection and a shield for Hamburg's commercial freedom. From it arose the bond which Hamburg made ever stronger in rights and duties by its water highway, the Elbe.

Thenceforth the counts of Holstein claimed no other rights, such as the appointment of a land prefect, and the administration of the city lay in the hands of four consuls. The imperial prefect left the place in 1223, and in 1225 the Emperor Otto IV gave Hamburg the rights of a free city of the empire, under the administration of the

council or city senate, and this it has remained from that day, through all the storms of the middle ages and of modern times, until now. It sought now, as necessity required, to increase its real estate by conquest or by purchase, and as the city meant to extend this property on both sides of the Elbe near by, it became exceedingly important as early as the middle of the thirteenth century that a part of the island of Neuwerk at the mouth of the Elbe should be acquired. Possession was obtained in 1394 of the castle and domain of Ritzebüttel, in order to give to commerce a firm point of support at the mouth of the stream. Cuxhaven, Hamburg's outer harbor at that point, has just now again acquired an enlarged meaning in the arrangements for the handling of the foreign commerce of the city.

Hamburg concluded with Lübeck, in 1242, an offensive and defensive treaty, wherein was laid the basis of the "Hanse," the league in which were united all the great, thriving, commercial German cities of the middle ages. Already, at the end of the thirteenth century, the city levied a duty (the Werkzoll) at the mouth of the Elbe on all vessels and merchandise, as compensation for the erection and maintenance of a lighthouse on the island of Neuwerk. To this was added a further tax, the "Tonnen- und Baakengeld" (tonnage and beacon dues), for the maintenance of beacons on the lower Elbe. The Emperor Karl IV confirmed to the city (1347–1378) the right which it exercised of punishing pirates within its district, and Frederic III enlarged this right in his grant of 1468, wherein he empowered the Hamburgers to seek out, to seize, and to condemn all criminals in neighboring principalities, districts, earldoms, and jurisdictions on the River Elbe and at sea. Ferdinand II confirmed to the city the right to levy the Werkzoll and the Tonnen- und Baakengeld even on those vessels not seeking the port of Hamburg (1628), and this right was continued by the following Emperors until the fall of the old German Empire.

Napoleon I crushed Hamburg's independence for a short time. It was the chief town of the department of the mouths of the Elbe from December 13, 1810, to May 26, 1814. Its commerce and navigation suffered greatly during that time, and its population was reduced by more than a fifth. The city's losses during the foreign occupation were reckoned at more than 147,000,000 marks-banco (about 223,000,000 marks of the present day = $44,600,000). After the foreign occupation it grew up in renewed independence, and after the great fire of 1842, in which the losses amounted to 41,000,000 marks-banco ($15,500,000), the city rose again rejuvenated, like a phœnix from its ashes. With the foundation of the new German Empire Hamburg, as an independent state, became an important member of the confederation, and to the blessings of this new Empire belongs not the least part of the unlooked-for rise of the commerce of the free Hanseatic city of Hamburg.

The State of Hamburg has now an area of 415 square kilometers, of which 77 square kilometers, with 726,000 inhabitants in round numbers, belong to the city. The north, east, and west outlying districts have about 260 square kilometers, with some 53,000 inhabitants. Far away from these districts, at the mouth of the Elbe (100 kilometers in round numbers northwest from Hamburg), lies the Ritzebüttel tract, with Cuxhaven and the island of Neuwerk, containing 78 square kilometers and 11,000 inhabitants.

It may be well, in closing this historical sketch, to give a small table showing the growth of Hamburg's population during the century just closed, the period which has seen the city's greatest development.

*Growth of Hamburg's population, 1811–1900.*

| Years. | Inhabitants. | | |
|---|---|---|---|
| | City (and suburbs). | Outlying districts. | Total. |
| 1811 | 100,192 | 31,815 | 132,007 |
| 1821 | 127,985 | 26,502 | 154,487 |
| 1830 | 144,383 | 29,560 | 173,943 |
| 1840 | 154,986 | 34,383 | 189,369 |
| 1850 | 171,013 | 43,628 | 214,641 |
| 1860 | 198,626 | 52,766 | 251,392 |
| 1870 | 284,492 | 40,740 | 325,232 |
| 1880 | 410,127 | 43,742 | 453,869 |
| 1890 | 569,260 | 53,270 | 622,530 |
| 1900 | 705,738 | 62,611 | 768,349 |

## THE ELBE AND ITS WATER CONNECTIONS.

Among the principal rivers of Germany whose navigable lengths, even to their mouths in the sea, are developed on German soil, the Elbe is the most important. It commands, through its many-branched network of navigable tributaries, a large part of north and middle Germany, and of the adjoining Kingdom of Bohemia. It is in direct communication by artificial canals with the basins of the Oder and the Baltic Sea. Having its mouth in the North Sea, it forms for the whole of its tributary country the most convenient route for the exchange of its products with those of all the countries of the world. The natural conditions of this stream are such that the leading seaport and business city of the German Empire must develop on its lower part.

It was allotted to Hamburg from the earliest times to play this part in the economy of the Empire. It was not its geographical position alone which qualified the city for this place. Its historical independent development and the unwearying energy of its inhabitants have contributed in equal measure to its importance. Hamburg has always held to the fixed purpose of being ready, by improving the Elbe and by enlarging her docks, for all the increasing demands of her commerce. A short study of the Elbe—the life artery of Hamburg—both in regard to its gifts from nature, and to what it has been made by art, will bring out clearly its importance for Germany's home and foreign trade and for the Empire's foremost business city.

The Elbe rises on the southern slope of the Riesengebirge or Giant Mountains in the Gitschiner region of Bohemia, at an altitude of 1,350 meters above the level of the sea. It is formed by the junction of several water courses, called Seifen or Flessen, of which the Elbseifen and the Weisswasser are the most important. These streams come from east and west and meet some 600 meters above the sea, forming a single course, with a southwardly direction, which near Hohenelbe (440 meters above the sea) leaves the mountains and becomes hence downward suitable for rafting. At the southern edge

of its basin in Bohemia the Elbe turns westward, and at its most southerly point, near Kollin, it takes for the first time the northwestward direction, which it holds until it reaches the sea.

The Elbe first becomes navigable at its junction with the Moldan, its largest tributary and the principal river of Bohemia. Down to this point, at Melnik, the Elbe has attained a length of 307 kilometers with a drainage area of 13,742 square kilometers. The drainage area of the Moldan is of 28,068 square kilometers. The fall of this stream is lighter than that of the Elbe; it is navigable from the junction with the Elbe to Budweis above Prague, a distance of 241 kilometers. Its total length from its source to the junction is 370 kilometers. After the Elbe has taken up the next most important Bohemian tributary, the partly navigable Eger, it breaks through the Bohemian Mittelgebirge (Midland range) and the Elbe sandstone range. While in this latter it crosses the frontier into Germany near Herrnskretschen, 12 kilometers below Tetschen. The river now flows through the noble Saxon Switzerland and the lovely curve of the valley near Dresden. It leaves below Meissen the Saxon mountain lands, whose range of hills divides, going to the right toward Riesa, and to the left, following along the river, toward Torgan. Some 14 kilometers below Riesa the Elbe runs quite straight to the point where it crosses the frontier between Saxony and Prussia, the lowlands of northern Germany.

From this point to its mouth the Elbe flows in a general northwest direction through the Kingdom of Prussia, except for a short section in the duchy of Anhalt (Rosslau, where is a harbor on the Elbe, and Dessau, the capital, with a harbor on the Mulde), and then reaches Magdeburg, the most important inland harbor on the river. It touches the grand duchy of Mecklenburg at Dönitz and Boizenburg, being navigable for inland traffic to Hamburg, Harburg, and Altona, a total length of 735 kilometers from Melnik. The lowest section of the river, used by ocean vessels, begins at the bridges across the Elbe from Hamburg to Harburg. The length of this section, to the mouth of the river at Cuxhaven, is 110 kilometers in round numbers. This part of the Elbe, as well as a length of some 40 kilometers above Hamburg, is subject to the ebb and flood of the tide.

The following table gives, opposite the names of various points on the course of the Elbe, the distance of each from the source, the height of each above the sea, and the drainage of all the basin lying upstream from any given point:

| | Distance. | Altitude. | Drainage area. |
|---|---|---|---|
| | *Kilometers.* | *Meters.* | *Sq. kilometers.* |
| Source | | 1,350 | 41,810 |
| Melnik (mouth of Moldau) | 307 | 161 | 41,810 |
| German-Bohemian frontier | 413 | 118 | 51,360 |
| Saxo-Prussian frontier | 534 | 87 | 54,750 |
| Junction of Saale | 704 | 50 | 94,050 |
| Magdeburg | 738 | 43 | 94,890 |
| Junction of the Havel | 844 | 23 | 122,200 |
| Hamburg | 1,036 | 1 | 139,700 |
| Cuxhaven (mouth of the river) | 1,141 | | 145,600 |

The drainage area opposite the junction of any tributary includes the area of the basin of that tributary.

The most considerable and navigable tributaries entering the Elbe within the limits of the German Empire are the Black Elster, the Mulde, the Saale with the Unstrut, and the Havel with the Spree. The Mulde and the Elster are navigable near their mouths only. The Saale has been made navigable for the past two hundred years up to and beyond Halle, as far as Naumberg, a distance of 180 kilometers. The Unstrut is canalized from its mouth near Naumberg to Bretleben, 77 kilometers. The most important German tributary of the Elbe is the Havel, with its affluent the Spree. The combined drainage area of the two is only 24,350 square kilometers, of which 10,104 square kilometers belong to the Spree. Being lowland streams the Havel and the Spree are navigable to a great extent. They subserve not only the very important water traffic of Berlin, the capital of the Kingdom of Prussia and of the German Empire, which lies on the Spree, but also, through the adjacent canal connections, the great navigable areas of the Oder, from Stettin to Breslau, and of its tributaries and, through their canal connections again, the Vistula.

Between the Havel and Hamburg the only tributaries worth mentioning are on the right bank, the Elbe and the Stecknitz; on the left bank, the Jeetzel and the Ilmenau with its affluent the Lühe. The Elbe comes in at Dömitz. It has maintained for a hundred years an insignificant traffic by water with Lake Schwerin by means of a single lock and dam. It is stated that this traffic extended formerly to Wismar through the so-called Wallenstein ditch. The Stecknitz enters the Elbe at Lauenburg, the point of departure of the century-old Stecknitz Canal to Lübeck on the Baltic. This water connection was rebuilt a few years ago, with modern dimensions and arrangements, as the Elbe-Trave Canal. The Jeetzel is navigable for 38 kilometers to Salzwedel, and the Ilmenau with the Lühe to Lüneburg, 29 kilometers, part of it by means of locks. The tributaries at Hamburg, the Alster and Bille, have locks. They, with their canals and Flethen, subserve the business within the city and the adjacent docks. (At the present time 108,000 goods barges pass through the Hammerbrook and Bille Locks every year.) The remaining tributaries of the lower Elbe, the Pinnau, Krückau, and Stör on the right bank, the Este, Lühe, Schwinge, and Oste subserve a mere strictly local traffic.

The Elbe empties into the bight of the North Sea, which receives the Weser. Although they obtain their water from very different districts and the Elbe drains a much larger area than the Weser, there is this in common between the two rivers, the tidal oscillation beyond their mouths is the same for both, while within their tidal districts there is no comparison between the oscillations of the tide and the water which the rivers receive from above. The angle between the axes of the outflowing masses of water from the Weser and the Elbe is so small that their directions coincide near Helgoland. The beds of both rivers, as well as their currents, can be followed some 15 or 20 miles beyond Helgoland. The flood tide from the North Sea comes in a northwesterly direction near Helgoland and near the junction of the outgoing streams. One part of any given flood tide enters the Weser, while the immediately adjoining part goes to the Elbe, so that it might be said of them, in the matter of the flood tide, that they are two branches from the same trunk. The tide

limit lies near Geesthacht, some 40 kilometers above Hamburg, where the mean high-water surface of the water from upstream intersects the mean water surface of the high tide. The length of the tidal district from Geesthacht to Cuxhaven is 142 kilometers. In case of heavy winds from the northwest the storm water may back the tidal limit 24 kilometers upstream, while exceptional high water from above may carry it 15 kilometers downstream. The tidal oscillation at Cuxhaven, taking the mean from 1878 to 1896, is 2.89 meters. Tidal observations were begun at Cuxhaven in 1843. The change in the greatest and least values in the moon's declination and in its distance pass through nearly a full cycle every nineteen years, so that in this period the influences of the different places of the heavenly bodies is neutralized. Now, if the tidal observations be grouped in periods of nineteen years, a remarkable fact appears. The average oscillation of the interval from 1843 to 1861 was 2.815 meters, while that from 1857 to 1875 was 2.788 meters, a falling of 0.027 meter. But from this time on an increase takes place, so that the oscillation from 1878 to 1896 was 2.89 meters, an increase of 0.102 meter. This increase in the tidal oscillation is due mainly to a raising of the high-water level. The average duration of the flood tide at Cuxhaven is five hours thirty-four minutes, while that of the ebb is six hours fifty-one minutes.

The tidal range at Hamburg is 1.89 meters. The flood lasts there four hours thirty-nine minutes, and the ebb seven hours forty-six minutes. The difference in the time of high water at Cuxhaven and at Hamburg is four hours twenty-two minutes, giving an average rate of tidal advance of 6.51 meters per second. The difference in the time of low water is five hours seventeen minutes, corresponding to a tidal propagation of 5.38 meters per second.

Setting aside a few insignificant islands, the Elbe comes below the tidal limit in a single unbroken stream. It first divides into two main arms, the northern and the southern Elbe, about 14 kilometers above Hamburg. The width of the river before it divides is from 315 to 500 meters. The northern Elbe, on which Hamburg stands, is 247 meters wide. The southern Elbe, alongside of which stands the city of Harburg, 6 kilometers below the division, is 280 meters wide and over.

On June 21, 1886, the discharge of the river in the section from Blankenese to below Gluckstadt was calculated from one observed tide. The average discharge above Hamburg was 510 cubic meters per second. In comparison with this quantity of water, which for the whole tide is calculated at 24,000,000 to 26,000,000 cubic meters, the discharges below Hamburg increase very rapidly. At Blankenese, 9 kilometers below Hamburg, the discharge is more than 60,000,000 cubic meters, and at Gluckstadt, 51 kilometers below, the discharge is 300,000,000 cubic meters. The greatest discharge in cubic meters per second was—

| At— | Flood. | Ebb. |
|---|---|---|
| Blankenese, 9 kilometers below Hamburg (about) | 5,000 | 4,500 |
| Schulau, 18 kilometers below Hamburg (about) | 7,500 | 6,500 |
| Gluckstadt, 51 kilometers below Hamburg (about) | 22,500 | 19,500 |

The Elbe is now navigable at high water all the way to the Hamburg docks for vessels drawing 7.5 meters. The least depth of water in 1900 was between Altona and Brunshausen; it was 5.5 meters at mean low water and 7.5 meters at mean high water. In 1902 it had been increased so that vessels drawing 7.9 meters could come all the way up without trouble. The channel is maintained almost entirely by dredging. A project to increase materially the useful channel depth up to Hamburg, by a correction of the Elbe, is in course of being carried out.

Since 1897 an improvement of the channel from St. Pauli, just below Hamburg, to Nienstedten has been going on in accordance with an agreement made between Prussia and Hamburg. A navigable channel 200 meters wide has been dredged along the left bank of the Elbe. The depth of this channel is set at 6 meters below the surface of summer mean low water. The channel is kept in place and protected from silting up by cross dykes and longitudinal works. Along the right bank, where the channel used to lie, a sheet of water has been shut off by a sort of levee built in the river. By this means a protected harbor has been formed here for the city of Altona, where the Dükendalba (a special form of mooring post) used to stand. The top of this levee is just above the surface of ordinary high water.

The construction of this levee is estimated at 1,530,000 marks, of which the city of Altona is to contribute 860,000 marks ($215,000).

In order to obtain as fair a division as possible of the high water at the dividing point at Bunthause, it is laid down in the above-mentioned agreement between the States that Prussia in the South Elbe and Hamburg in the North Elbe may cause a channel to be dredged at any time, but that the breadth at bottom must not exceed 200 meters, nor the depth, at summer mean low water, 3 meters.

The cost of the projected correction is estimated at 8,127,000 marks ($2,031,750).

The channel of the Elbe and of its most important tributaries has been greatly improved by regulating works during the past fifty years. In 1869 barges of 250 tons capacity were rarely seen, while now the largest of them, measuring 70 meters long, 10 to 11 meters wide, and 1.85 meters depth, carrying 800 tons, can be used at nearly every season of the year. The part of the Elbe in Bohemia from Aussig to Melnik, and the Moldan from Melnik to Prague, have been canalized, with the result that their capacities have been largely increased. This is very likely the first step toward the long-talked-of Danube-Moldan-Elbe Canal. The great elector of Brandenburg, who called into existence the canalization of the Saale, built in 1662 to 1668 the first canal connection between the Spree and the Oder, the Müllroser or Friedrich Wilhelm Canal. Frederick the Great made in the eighteenth century a second connection with the Oder by the Finow Canal. The Plauer Canal, between the Havel and the Elbe, was also built by this Prussian King. A better connection between this canal and the Elbe, by means of the Ihle Canal, was built later on by this same King. It is now intended to improve this double connection between the Elbe and the Oder by a new canal in place of the Finow—the "Grossschiffahrtsweg Berlin-Stettin" (the great Berlin-Stettin navigable way). To these existing water connections with the east will probably be added ere long, as a complementary member, the

"Mittelland" (Midland) Kanal, which will join all of western Germany to the Elbe.

The free Hanseatic city of Lübeck constructed lately the new Elbe-Trave Canal, in place of the former Stecknitz Canal, so as to obtain a suitable outlet through the Elbe to the interior for its business. This gave to the Elbe an outlet to the Baltic for the inland trade. The Kaiser Wilhelm Canal, built for ocean traffic by the German Empire, from Brunsbüttel on the lower Elbe to Kiel on the Baltic Sea, must also be considered as another mouth for the Elbe, one for ocean commerce to the East or Baltic Sea. Although neither of these two canals was built in Hamburg's interest, their opening has caused her business relations to extend and multiply.

Hamburg's own work and care embrace mainly the lower Elbe; that is to say, from the main bridge across the Elbe to the ocean. The division of the river within her limits forced the city into an intense improvement of the arm of the Elbe which it controlled. This arm is called the "North Elbe" and must be recognized as the main arm. The beginning of the works of improvement dates from very far back. In 1550 the Grandeswärder, in the delta of the Bille, was cut through by an open canal, which first brought the Elbe alongside of the city, about in the place now occupied by the present Oberhafen and Zoll Canals. Ever since that time Hamburg has stood on the bank of the Elbe. The real North Elbe was first improved in 1570 by cutting through the Spadenlander grove (about 8 kilometers above the city). The "Neue Graben," nearly 2 kilometers long, was built in the beginning of the seventeenth century on the Grasbrook near Hamburg, on the line of the North Elbe of to-day. The principal object of all these works was to obtain an improved flow of water and to maintain its depth in the docks and roadstead. The cut made through the Kalten Hofe, 1875–1879, just above the city, had the same object in view; so, too, had the final and complete improvement of the North Elbe, which, begun about 1850, was going on actively at the same time.

The improvement of the lower Elbe for facilitating navigation had been extended already in former centuries to a suitable marking and lighting of the channel and to the regulation and control of the pilotage service. Hamburg had already maintained since 1296 a lighthouse on the island of Neuwerk, which, still standing on the site of one much older, looks back over six centuries. The beaconage and buoyage for day travel, begun at about the same time, had grown to a high degree of perfection by the end of the seventeenth century. The main channel of the lower Elbe is marked now by 134 buoys, to which should be added a few shore beacons. Finally, there must be included the fixed lights for night travel. To the old Neuwerk fire tower was added another, placed on the island of Helgoland about the end of the seventeenth century, and maintained by Hamburg until 1806. The third lighthouse in order was the one erected at Cuxhaven in 1802–3. The first lightship was anchored off the mouth of the Elbe in 1816, and since then, during the entire course of the nineteenth century, the night marking of the Elbe continued to develop until its present perfection was reached. The main channel of the lower Elbe, from the North Sea to Hamburg, is now illumined by 41 lights, located and maintained by the State of Hamburg. Of these 31 are lighthouses and lighted beacons, 4 are lighted buoys, and 6 are lightships. Four

of the lightships are at the mouth of the Elbe, where a pilot boat, which serves as a relief lightship, is constantly at anchor. Moreover, 5 Hamburg pilot schooners and 2 pilot steamers cruise at various points in order to give to incoming ships a competent guide to steer them safely to the Hamburg docks.

Since the middle of the century just passed the methods of carrying on the well-fostered improvement of the lower Elbe have been extended to deepening and smoothing out its bed by dredging, and to the maintenance of an ice-breaking service in winter. Since that time the stretch of bars in the neighborhood of Blankenese (from Altona down to Twielenfleth) has been deepened by systematic and steady dredging. In 1841 only vessels drawing at the most 4.3 meters could come to Hamburg at high water unhindered and without lightering. In 1874 this draft had increased to 6.2 meters; in 1889, to 7.2 meters; and in 1902 to 7.9 meters.

A tide signal has been built on the lower Elbe, near Brunshausen, to let the big vessels in the Hamburg docks know the correct stage of water on the bars. The lightering roads, that is the place where the new deep-draft vessels which can not take on a full cargo at Hamburg finish their lading, are also at Brunshausen. Projects are now in preparation for obtaining, by more dredging, and especially by a systematic correction of the lower Elbe, greater channel depths suited to the ever-increasing draft of the ocean giants. The first beginnings of such a correction have already been made on the section of the Elbe near and below Altona.

Ice breaking in the Elbe used to be carried on by hand with great difficulty and small result. The first steam ice breaker began work in 1871. During the past ten years, even in the most severe winters, the lower Elbe and the Hamburg docks have been kept passable for seagoing vessels by a fleet of 7 ice-breaking steamers. These 7 vessels have a total of 3,722 indicated horsepower. The largest of these vessels has 1,200 indicated horsepower. These steamers are much like ordinary tugs in appearance. The keel is inclined, being low in the water at the stern and high at the bow, so as to ride up on the ice, which is crushed by the mere weight of the vessel. Hamburg was the first German port to combat the dangers and delays of the ice season by means of special ice-breaking steamers. Her success caused other States—Lübeck in 1879, Prussia in 1881, Bremen in 1888—to organize similar services. The excellence of this service on the Elbe is such that any material interference with navigation, or any danger to the country, the dykes, or the harbor works by the formation of ice seems, for the future, to be practically eliminated.

## THE PORT OF HAMBURG.

The original Hamburg lay, as already stated, not on the Elbe, but on the high ground by the Alster, from St. Peter's Church to the present city hall market. The fish market still indicates the market place for the oldest business of the inhabitants—fishing. It was about here that an enlargement of the city was made in the ninth century. For this extension the waterway lying south of Grosse- and Kleine-Reichenstrasse formed the city ditch. The first commercial business settled probably around what is now known as Reichen-

strasse. Its site was bounded by the so-called city ditch, into which the small light-draft vessels of that time could enter. Here are to be sought the first beginnings of the port of Hamburg. In the course of the next hundred years the broad mouth of the Alster and large tracts of ground lying to the south and west were incorporated into the town. These tracts had become habitable by diking and by raising the surface of the ground, and the deep water of the Alster made for those days a roomy and excellent harbor. This part of the mouth of the Alster, now inclosed between the "Grimm" and the "Neueburg" below the very old "Zollenbrücke," must have served as the port until about the twelfth century.

As a consequence of the destruction of the old business town of Bardowick by Henry the Lion in 1189, the navigation interests of this town moved over to Hamburg, and many business men from Bardowick sought new homes there. The result was that the city's harbor grew and spread during the first half of the thirteenth century nearly to where the Alster now discharges into the Binnenhafen near the Höhebrücke. Still larger portions of the mouth of the Alster were needed for the port, and by reason of the increase of draft and size of the vessels, as well as of the necessity of establishing bridges, the old part of the harbor had to be abandoned. So the port of Hamburg was moved in the thirteenth century to what is now the Binnenhafen, whose depth was thoroughly scoured as far back as 1258 by letting in the Bille (now the Zoll Canal). This arrangement sufficed for about two hundred years. But when a lock was placed at the mouth of the Bille, in 1491, the effective action of the water flowing through the port ceased, and as the size of the vessels grew outcries about the lessening depth of the port increased, about the beginning of the sixteenth century. The cut through the Grandeswärder, already mentioned, was the consequence of this demand, and in 1550 the port was for the first time traversed and scoured out by the Elbe itself.

In the seventeenth century the port was extended toward the present Niederhafen, and the Elbe proper was first used for harbor purposes. A row of piles for tying up vessels was placed at a little distance from the shore. A row of Duedalben (a special form of mooring post) was driven outside of the piles for the first time in the second half of the eighteenth century (1768), and in 1798 a second row was added. The port offered at that time plenty of space for 400 vessels. The Niederhafen reached its maximum development in 1840 and formed the most important part of the harbor for seagoing vessels until the time when commerce and industry, changing by reason of steamships and railways, called for the establishment of regularly equipped quays.

So far only berths in the river had been asked for seagoing vessels, and business with the shore had been carried on by small harbor craft. Meanwhile, the example of the English ports had shown how much greater were the convenience and productiveness of a dock which, with its deep-founded quay walls, allowed direct communication between the ships and the shore. When the first projects for docks of this sort were prepared for Hamburg, England and its docks were taken as a pattern. Fortunately, the inapplicability of this system was perceived in time (the construction of a dock had been

begun already in the large Grasbrook during the fifties). The coasts and coast rivers of England with their extraordinary tidal oscillations (the normal difference between high water and low water being about 6 m. at London and 8 at Liverpool), and their heavy deposits of silt forced the use of closed docks. But the normal oscillation at Hamburg is 1.90 m., in round figures, and the deposit of mud is very small, so the solution of the question was found in the far simpler and more practical open tidal basins. The first open dock in Hamburg, the Sandthorhafen, came into use in 1866. Until then the Niederhafen was steadily extended to the west, as far as the boundary of Altona. Ducdalben for mooring vessels had also been driven along the farther shore. With 1866 the era of modern dock construction and management began.

The modern docks added to the traditional berths for seagoing vessels, in the open river, berths alongside of shore quays, where vessels have at their disposal the means best adapted to quick loading and discharging of cargo. Steam and electric derricks for hoisting goods, sheds for temporary storage, for collecting and distributing merchandise; railways and roads for the delivery and removal of goods to and from the country are here at the disposal of vessels. The use of the quays is naturally more expensive, and for that reason it is well suited only to ocean steamers, and of these only to the ones carrying the more valuable cargoes. But there is at the Hamburg docks a very extensive export and import trade in package goods. Goods in bulk will be taken in or discharged, as formerly, on the open water, where large vessels can lie to the mooring posts. At the same time a large part of the business of the port done with the equipment of the quays has to be continued by water. The carrying of goods by water within the port and the city forms a characteristic system of transportation carried on by means of "Schuten," small stoutly built barges, of which thousands enliven the docks, canals, and "Flethen" of the city. They are towed, as a rule, by the harbor tugs. Goods forwarded by the Elbe to the country or received thence by the same route go up the river by barges called in Hamburg "Oberländer," or down the river by small sailing vessels called "Ewer," and also, naturally, in both directions by steamboat.

A very important part of Hamburg's business is the reforwarding in other vessels of goods arriving by sea, inasmuch as a large part of the incoming merchandise is not for Germany or for land transportation. Much the larger share goes to other ports, part in the original packages, part after being stored for a greater or less length of time or after the goods have been refined or finished, sorted or repacked. Hamburg's position as a free city gave, in the far-distant past, the opportunity for the development of this voluminous and important business. With the foundation of the new German Empire (that is, with the foundation of the North German Customs Union) Hamburg found herself in a peculiar position. So long as she lay, in the interest of her affairs, completely outside of the German customs frontier she was a foreigner in the matter of duties. The termination of this untenable position and the adhesion of Hamburg to the customs union of the German Empire were brought about in the eighties by the great chancellor, Prince Bismarck, and were consummated on October 15, 1888, by the opening of the free port.

To this end the extended and enlarged port of Hamburg, with the exception of a few parts, was decleared to be a free port, and was surrounded by a well-guarded customs boundary line. Provision must be made within this line for the storage and arrangement of merchandise. In addition to the docks proper the free port contains large tracts of ground for warehouses, factories, and shipyards. Its total area is 987 hectares, or nearly 10 square kilometers (3.86 square miles). It does not border immediately upon the city, but leaves the "Zoll Canal" between them free, more as a customs inland waterway in order to preserve a connection independent of the free port between the city canals and the upper and lower sections of the Elbe. The only inland customs dock to which ocean vessels can find access is on this water connection, in the Niederhafen; it extends downstream to the Altona line. A few inland customs ports for river vessels are found up the Elbe. By the side of these docks and on the canals and "Flethen" of the city stand the inland bonded warehouses of the Hamburg merchants. The blocks of warehouses in the free port stand on special "Flethen" at the edge of the city and directly south of the Zoll Canal. These belong mainly to the Hamburger Freihafen-Lagerhaus-Gesellschaft (Hamburg Free Port Warehouse Company), from which they are leased. This warehouse quarter, created in 1885, has undergone in the last few years a great extension, which is not yet ended. It stands where a thickly built up part of the city formerly housed some 20,000 men, all of whom had to be evicted. The warehouses of the free port cover a ground space of more than 41,000 square meters. The total floor surface of their cellars and of their 5 to 7 stories measures 242,000 square meters, in round numbers, and can hold 440,000 tons of merchandise. Improvement operations are carried on in some of them (for example, the sorting of coffee). In accordance with the business ways of Hamburg, the warehouses do not stand by deep water, but rather where they can be reached by the "Schuten" and "Oberländer." Only two warehouses, and they belong to the State, stand by deep water (those on quays A and B, at Kuhwärder). They suffice for all needs here.

The ocean docks proper are connected with the warehouse quarter. The most important of these docks are the above-mentioned Sandthor dock, the first and the oldest (opened in 1866); the Schiffbauer and Grasbrook docks (1872), Petroleum dock (1876), Strand dock (1879), Baaken dock (1887), and the Kirchefauer dock (1891), all on the right bank; and farther away, on the left bank, are the Segelschiff dock (1888), Hansa and India docks (1893). The total water surface of the Hamburg free port was, at the beginning of 1902, 384 hectares (945 acres), of which 133 hectares are devoted to seagoing vessels, 55.8 hectares to river vessels (Moldau, Saale, Spree, etc., docks), 80.3 hectares to canals and side branches, 114.9 hectares to the open Elbe near the entrance to the docks.

The oldest docks (Sandthor and Grasbrook) have a depth of only 5 to 6 meters; the newer ones (Segelschiff and Hansa) have 6 to 6.5 meters at mean low water. The question of deepening these last-named docks is under consideration.

The Hamburg docks establishment is now undergoing an important extension in the docks under construction (and now, 1903, nearly completed) at Kuhwärder, between the Reiherstieg and the Köhl-

brand. Three large docks are located there: The Kuhwärder dock, with a water surface of 22.3 hectares; the Kaiser Wilhelm dock, of 22.6 hectares; and the Ellerholz dock, of 30.9 hectares; in all, 78.5 hectares of water surface. The last two have a depth of 10 meters below mean high water, or 8 meters large below mean low water. They are intended for the use of the Hamburg-American Line, and will be fully equipped at once with sheds, derricks, tracks, etc.

The most important quays for ocean vessels at these docks are the Sandthor quay (in use since 1866); Kaiser and Dalmann quays (1872); Hubener quay (1877); Strand quay (1879); Versmann quay (1888); Petersen quay (1891); Kirchenpauer quay (1892). On the left side are the American quay (1888); Segelschiff quay (1889); Asia quay (1890); O'Swald, Australia, India, and Africa quays (1893). The last-named quays were only partly built up at first with sheds, which were lengthened afterwards as necessity required. Now there are but few unoccupied sections.

The total length of quays for the ocean traffic was, in 1902, 15.1 kilometers, to which must be added 5.6 kilometers of built-up shore leased to private parties (shipyards, factories, etc.), and 1.25 kilometers of shore, intended for seagoing vessels, but not yet built up in quays; in all, 21.95 kilometers of quays and sections of shore.

The new docks at Kuhwärder have the following lengths of quay: Augusta-Victoria quay, 1.1 kilometers; Reiher quay, 0.2 kilometer; Kronprinz quay, 0.9 kilometer; and Mönckeberg quay, 0.9 kilometer; a total length of 3.1 kilometers. The built-up sides of the Kuhwärder dock are 2 kilometers long.

For river vessels there are available 28.5 kilometers of shore, of which 3.72 kilometers finished by the State and 14.9 kilometers leased to private parties. To these must be added 3.3 kilometers of shore for river vessels in the Oder and the new Ellerholz docks.

The sheds in use on the quays in 1902 vary from 15 to 35 meters in width and from 110 to 300 meters in length. The oldest are the shortest and narrowest, while the newest are the widest and longest. They all have a floor about 1.2 meters above the roadway and railway tracks alongside. The total length of then existing sheds was 9,729 meters, and the space covered was 264,360 square meters gross.

The floor area of the new sheds of the Kaiser Wilhelm and Ellerholz docks is 53.6 to 61.6 meters wide and up to 400.4 meters long. Their total length is 2,490 meters, and the area of the storage space is 137,500 square meters. These present arrangements can be enlarged about 50 per cent.

Beyond these the warehouses on quays A and B, 6 to 12 stories in height, with a total of 32,000 square meters of storage space, alone are in the dock district. The other warehouses lie mostly on the canals, where the water is not so deep and where the direct transfer of cargo between ocean-going vessels and the warehouses can only take place exceptionally. As a rule, goods come first to the sheds where they are sorted; they are then shipped by rail or river, or else they are taken by the "Schuten" for eventual storage in a warehouse. In addition to the private warehouses in the city, mention should be made of the buildings of the Freihafen-Lagerhaus-Gesellschaft on the Kleiner Grasbrook and the Steinwärder. These warehouses were built in 1884; they are 6 to 8 stories high and are plentifully sup-

plied with hydraulic lifting apparatus (derricks and hoists). These buildings occupy a total ground surface of 42,000 square meters, and their total storage area is more than 240,000 square meters. The floors can withstand a load of 1,500 to 1,800 kilograms per square meter (307 to 368 pounds per square foot).

The warehouse district of the Freihafen-Lagerhouse-Gesellschaft has been very greatly increased lately by the further improvement of the so-called "Wandrahminsel" by canals, roads, and warehouses, and by the new constructions on the left shore of the Elbe.

The derrick equipment for the maritime quays is as follows:

1 large steam pivot derrick 31 meters high, 10 meters overhang, 150 tons capacity at the Krahnhöft.
1 large steam pivot derrick, 50 tons capacity, at the Krahnhöft.
1 large steam pivot derrick, 12.5 tons capacity, at the Krahnhöft.
2 electric derricks, 30 tons capacity each, at the Krahnhöft.

Inside of the buildings or attached to the outside walls (driven by four 14-horsepower gas motors):

Quay warehouse A—

| | Kilogram capacity. |
|---|---|
| 4 hydraulic derricks | 1,500 |
| 4 hand derricks | 1,000 |
| 4 hydraulic lifts | 1,000 |
| Quay warehouse B— | |
| 8 friction windlasses | 750 |
| 2 hand-crank windlasses | 1,000 |
| 1 lift. | |
| Sheds of the Magdeburger quay: | |
| 17 fixed hydraulic derricks | 2,000 |
| Harburger street export sheds: | |
| 6 fixed electric derricks | 2,500 |
| 1 hand derrick | 2,500 |
| Fruit shed A: | |
| 1 fixed electric derrick | 2,500 |
| Fruit shed B: | |
| 1 fixed hand derrick | 2,500 |
| Shed No. 16: | |
| 2 fixed hand derricks | 2,500 |
| The movable derricks placed on the water side of the above three sheds are included in the next item. | |
| On the land side of the sheds for passing Schwergut from the sheds to the drays or railway cars or the reverse: | |
| 42 hand derricks (part fixed, part movable, for short distances) | 2,500 |

Cargo is taken on board or discharged by means of a large number of electric or hand derricks, which can be moved on rails along the water side of the quays. The old steam derricks had each its own boiler. As now arranged, the motive power, steam or electricity, is generated at a central station, brought in mains by the side of the sheds, and distributed to the derricks by suitably spaced connections. The hand derricks are used only for lowering purposes. The old traveling derricks move on a track on top of the quay. The new ones are half-portal derricks under which freight cars can pass. There are in all 448 traveling derricks in use, divided as follows: 263 steam derricks, 1,500–2,500 kilograms capacity; 84 electric derricks, 2,500–3,000 kilograms capacity; 95 hand derricks, 1,000 kilograms capacity; 1 steam derrick, 7,500 kilograms capacity; 3 steam derricks, 5,000 kilograms capacity (each); 1 steam derrick, 3,000 kilograms capacity; 1 steam derrick, 1,000 kilograms capacity.

The new Kuhwärder docks have 1 electric derrick, 75 tons capacity; 1 electric derrick, 20 tons capacity; 1 electric derrick, 10 tons

capacity; 18 wall derricks, 2,560 kilograms capacity; 119 electric movable derricks, 3,000 kilograms capacity; 3 coal tips for loading railway cars.

This gives a grand total of 689 hoisting machines varying in power from 2,200 pounds to 165 tons of 2,000 pounds.

The entire dock district is provided with a widely ramified network of rails connected directly with the main railway lines which have their terminus in Hamburg. The length of the port tracks on the right shore of the Elbe is 65.7 kilometers, and on the left shore 75.7; in all, 141.4 kilometers, with 513 switches. There are also private sidings with 14.1 kilometers of tracks, so that the total length of tracks is 155.5 kilometers. At the east end of the Kirchenpauer quay is the Kohlenbahnhof (coal station), under the management of the Royal Prussian State Railways, with 3.4 kilometers of tracks and 12 switches. The new Kuhwärder docks will have 22 kilometers more of tracks.

There are on the south side of the Elbe, within the limits of the free port, a large number of private shipyards for the construction and repair of ocean and river craft, whether built of wood or iron. These yards are provided with floating and dry docks, patent slips, etc. The most important is the shipyard and machine works of Blohm and Voss, at Kuhwärder. This yard has several large floating docks, of which the newest can take in the largest merchant or war vessels. This yard employs more than 4,000 hands. The State's yard at Steinwärder repairs and renews all the working parts of the dredges belonging to the State. Many factories and workshops connected with the export business and with navigation interests lie within the free port. As the customs authorities allow only the essential supervising personnel to live inside of the free port, extensive provision must be made for moving and taking care of the army of day laborers who work at all points of the free district. Very many landing places are available for public and private steam ferries, and a number of cook shops, the so-called "Volkskaffeehallen," provide for the nourishment of workmen, seamen, and functionaries.

## CUXHAVEN, HAMBURG'S OUTER HARBOR.

There is yet to be mentioned a part of the port of Hamburg, a supplementary member, which, unimportant as it may appear at first glance, commands, as a necessary advanced work of Hamburg's commerce, the mouth of the Elbe, the port of Cuxhaven.

As Hamburg had obtained possession of the Ritzebüttel jurisdiction at the mouth of the Elbe, in the fourteenth century, in order to prevent effectively the increasing number of cases of shipwreck and piracy, the State's care and aim were bent on buoying and guarding the mouths of the Elbe; on erecting and maintaining the beacon light on the island of Neuwerk; on looking after the pilotage and safety services, and obtaining and organizing a good harbor of need and salvage. A harbor of safety, though an imperfect one, existed in the thirteenth and fourteenth centuries near the island of Neuwerk, which had come about a century earlier into Hamburg's possession, and near which lay the deep channel. This oldest harbor of refuge was taken

off, at the end of the fourteenth century, from the better inner part of the Aussenpriels of Ritzebüttel.

In 1618 an item regarding the port of Ritzebüttel was contained in a declaration of the Senate of Hamburg, in accordance with which the foreland, or the ground at that time outside of the dykes, was to be inclosed by dykes and to be provided (at the upper end of the Priel) with a drainage lock, by means of which a port for sea-going vessels could be formed "wherein mariners could lay their vessels and cargoes in safety during the winter." The channel had been pushed in the course of time northward from the shore, but the harbor of safety had again been brought back near the channel by means of the dyking mentioned, by which about 1,600 hectares had been reclaimed. This harbor was larger and better than the old one and was probably very much used, because in 1623 the Senate appointed a harbor master and overseer for Kuckshaven, and also for the lock and Haubt itself at Ritzebüttel. The name of Cuxhaven is mentioned here for the first time.

The harbor and dyke of 1618 did not last long. The river changed at that time the tendency of the movement of its deep channel and returned again toward the old Ritzebüttel shore. As far back as 1749 parts of the imperilled dyke must have been moved back, and this setting back was repeated ten times up to 1791. Of the 1,600 hectares reclaimed in 1618, scarcely 160 remained at the end. Costly shore protection works prevented the river at last from swallowing up any more land. Still it was feared, in the middle of the nineteenth century, that the stream would have the better of the struggle, but to-day the 10 kilometers of shore are thoroughly secured by rip-rap revetments and cross or spur dykes.

The port of 1618 was forced shorewards at the same time as the dykes, and the head of the port was, in 1729, the first firm point which successfully resisted the river. It was accomplished by the sinking of three old hulks, one of which was called "Die Liebe," and from this must have been given the name "Die alte Liebe" to the harbor head, still used to-day as a landing place. The so won Schutzhafen (harbor of safety), the present old port of Cuxhaven, was constantly enlarged and deepened, the last substantial work being done in 1868. In 1785 a pile breakwater, known as the "Schutzhöft," was built, and thus was obtained the Quarantänehafen (Quarantine dock), which was doubled in size in 1858. It is no longer used for its special purpose, as a new quarantine station, with a landing bridge, was built amid solitary surroundings further up the Elbe. During the ten years 1878–1887, 3,287 ocean vessels used the harbor of Cuxhaven. Of these, 2,459 sought refuge from contrary winds, ice runs, damages, and other causes. Only 828 served local commerce or trade. The port is used mainly at times of storm and ice. For instance, there lay in the port at one time, October 3, 1889, 180 fishing smacks and 120 other sea-going vessels.

But the necessary depth for the new deep-draft vessels was lacking at Cuxhaven. It seemed also necessary to build a special protection harbor for the fishing fleet, which filled the entire port at times. So it came about that in 1890 two new basins were begun, one of which, the fishing port, was put into service in 1892. The construction of the deep-water docks, which have a mean low-water depth of 9

meters and very nearly of 12 meters at mean low water, was so far advanced in 1895 that protection could be offered to the largest sea-going vessels. These new docks comprise three parts: The main dock, which has an entrance of 100 meters in width between the pier-heads, and a water surface nearly trapezoidal in shape, 165 meters wide just behind the pierheads and 250 meters wide on the land side, with a length of 300 meters; and two arms, each 300 by 80 meters, separated by a pier 300 by 90 meters. These two arms are parallel to each other; they lie about northeast and southwest. Only one of the arms is finished. Both can be doubled in length if necessary.

The whole establishment is founded on the basis of being a business port, the passenger traffic standing in the first line. For this purpose the 100-meter wide entrance is flanked on each side by a pierhead 120 meters long and 9 meters wide, alongside of which the giant steamers can lie to land and embark their passengers and baggage as quickly as possible. The steamers lie in the port proper to load or discharge cargo, coal, and provisions. The port is completely surrounded by quay walls.

The deep harbor at Cuxhaven was given over to use as a business port, in the accepted sense of the term, on June 1, 1902. The Hamburg-American Line sends out now its double-screw fast steamers and its other big passenger steamers from the west pierhead. It has leased for this purpose the greatest part of the west quay, which has been equipped in the last three years with tracks, derricks, sheds, waiting rooms, and customhouse. The port is free, like the establishment in Hamburg, and is surrounded by a well-guarded customs boundary. The incoming passengers land at the pierhead, whence they pass into the customs inspection rooms, and thence into elegant waiting rooms with their attached restaurant. Near-by stands the Hamburg Express ready to take the passengers on to their destination. The steamers, after landing their passengers, are warped at once into the harbor, in order to discharge their cargo at the west pier and prepare for their next departure. In winter, when the passenger traffic is largely suspended, the deep port can serve also as a harbor of refuge and protection.

It remains now to be mentioned that since the cholera year, 1892, the quarantine station at Cuxhaven has been greatly enlarged and improved. Extensive hospitals, a disinfection plant and belongings, accessible by a special landing bridge, have been erected on a solitary tract of ground near Groden, about 2 kilometers eastward from the deep port. This establishment is security that, in the matter of health for the future, Cuxhaven will be Hamburg's port of protection in time of trouble. As can be seen, the development of the port of Cuxhaven follows closely on that of Hamburg. Cuxhaven, as the necessary advance post of the world port, the old Hanseatic City, keeps guard at the mouth of the Elbe, and the wise discretion of the forefathers, who secured the Ritzebüttel district more than five hundred years ago, is bearing good fruit for their posterity.

### HAMBURG'S SHIPPING TRADE.

The size and growth of Hamburg's port equipment correspond to the traffic there developed. It is necessary for a full understanding of the latter's extent and meaning to study in its broadest lines, at

least according to its size, the evolution of the city's commerce and industry. It is interesting to note at the start that Hamburg's preponderating ocean traffic lies in the hands of her own people, and that the Hamburgian spirit of enterprise itself has given the greatest impulse to that traffic's development and flourishing state. It is not yet a decade since the German navigation colors in the Port of Hamburg passed ahead of those of England, which ere then had control of the greatest part of Hamburg's ocean carrying trade. It is, however, Hamburg's pride to stand to-day alongside of her sister city, Bremen, at the crest of the movement for the development of the carrying trade of the seas not only of Germany but also of the world. Consequently a sketch of the rise of Hamburg's special sea trade in the course of the century just past, as well as a general review of the equipment which carries on this traffic to-day, might now be given.

Almost no reliable list is at hand for the beginning of the last century. It appears, however, from the limited data to be had that Hamburg's commercial fleet numbered, about 1800, 250 vessels, in round figures, having a total carrying capacity of 36,325 registered tons, an average of 145 registered tonnage per vessel. This number of merchant vessels one would rarely have seen surpassed in a very long trip, and then only by a very small amount. In the first decade of the nineteenth century Hamburg's trade, and with it her fleet, fell off considerably. The city recovered very slowly and with great difficulty from the French occupation and its consequences. Only some 60 vessels flew the Hamburg flag in 1830. Accurate information as to the number of vessels belonging at Hamburg can be had since 1836. Their number and size for characteristic years are given in the following table:

*Condition of Hamburg's seagoing vessels since 1836.*

| Year. | Sail. | | | Steam. | | | Total. | |
|---|---|---|---|---|---|---|---|---|
| | Number. | Net registered tons. | Mean. | Number. | Net registered tons. | Mean. | Number. | Net registered tons. |
| 1836 | 146 | 25,722 | 176 | ..... | ..... | ..... | 146 | 25,722 |
| 1841 | 202 | 36,524 | 181 | 2 | 1,161 | 580 | 204 | 37,685 |
| 1848 | 250 | 51,975 | 208 | 7 | 1,793 | 256 | 257 | 53,758 |
| 1851 | 343 | 75,660 | 221 | 8 | 2,264 | 283 | 351 | 77,924 |
| 1857 | 471 | 131,425 | 279 | 20 | 12,008 | 600 | 491 | 143,433 |
| 1865 | 517 | 172,878 | 334 | 22 | 15,469 | 703 | 539 | 188,347 |
| 1869 | 437 | 161,591 | 370 | 36 | 29,540 | 821 | 473 | 191,131 |
| 1872 | 340 | 125,427 | 369 | 62 | 54,132 | 873 | 402 | 179,559 |
| 1873 | 335 | 124,094 | 370 | 82 | 77,418 | 944 | 417 | 201,512 |
| 1874 | 339 | 127,486 | 376 | 103 | 88,258 | 857 | 442 | 215,744 |
| 1882 | 329 | 138,462 | 421 | 162 | 149,774 | 925 | 491 | 288,236 |
| 1888 | 271 | 146,983 | 542 | 230 | 237,327 | 1,032 | 501 | 384,310 |
| 1889 | 266 | 156,064 | 587 | 271 | 308,718 | 1,139 | 537 | 464,782 |
| 1890 | 275 | 164,807 | 599 | 312 | 373,422 | 1,197 | 587 | 538,229 |
| 1891 | 280 | 175,878 | 628 | 318 | 393,360 | 1,237 | 598 | 569,238 |
| 1895 | 290 | 190,451 | 657 | 360 | 474,348 | 1,318 | 650 | 664,799 |
| 1897 | 300 | 200,518 | 668 | 377 | 514,949 | 1,366 | 677 | 715,465 |
| 1899 | 287 | 218,766 | 762 | 439 | 637,853 | 1,453 | 726 | 856,619 |
| 1900 | 314 | 242,661 | 773 | 488 | 745,995 | 1,529 | 802 | 988,656 |

While, according to this table, the Hamburg shipping trade disposed in 1836 of 146 seagoing vessels, with 26,000 registered tons in round numbers, it owned in 1900—that is, sixty-four years later—802 vessels, with a round 989,000 registered tons. The number of vessels increased more than five times, but the carrying capacity had

grown more than thirty-eight times in that space of time. Then the Hamburg fleet was composed wholly of sailing vessels. The first two steamers on Hamburg account were put into service in 1841. The first English steamer arrived here in 1816, and in 1825 a regular line of steamers from London and Hamburg was already in existence. This new form of navigation entered the Hamburg shipping trade late and made its way slowly. A very general opinion exists nowadays that steamers are crowding out sailing ships. This is not true, as the table shows, of the shipping trade of Hamburg. The tonnage of sailing vessels reached a maximum in 1865, then it fell off, as steam navigation developed, reaching a minimum of numbers and tonnage in 1873. Steamship tonnage exceeded sail tonnage for the first time in 1882, still the latter was improving and increased steadily, although the number of sailing vessels fell off still further until 1889. Since then a greater maximum of tonnage than that of 1865 was reached in 1891. A healthy development is now manifest and has been so for some time. The growth of the steam fleet is certainly very much greater, and for the last twenty years it has become constantly more and more important than that of the sailing fleet.

Each sort of navigation compensates, fortunately, the deficiencies of the other. Sailing vessels carry goods in bulk almost exclusively, as for these cheap transportation is rather to be desired than quick. The steamers have, by their swift, short trips, opened up for themselves a large part of their special field of work (transportation of foreign fruits, meats, live animals, etc.), a territory which never belonged to sailing ships. The influence of steam navigation on sailing vessels shows itself, however, in the steady growth of the size of the vessels. Whereas the mean tonnage of steamers in 1848 was 256 registered tons, it rose in 1900 to 1,530 registered tons, or six times as great. In the same period the average tonnage of sailing vessels increased from 208 registered tons to 783, or nearly four times as much. The old historic three-masters have been set aside for the four-masters. The five-masted bark *Potosi*, of 3,854 registered tons, which is, up to the present time, the largest and speediest sailing vessel in the world, has belonged to the Hamburg fleet since 1895. The largest ocean steamer belonging to Hamburg is the double-screw, fast steamship *Deutschland*, of 16,500 registered tons capacity.

It is worth while to notice the spasmodic growths of Hamburg's fleet, it being largely dependent upon political events. For example, after 1848; after the Crimean War of 1855; after the Franco-Prussian War of 1870–71; and, furthermore, after Hamburg's being included in the German customs union in 1888, and finally, the whole extraordinary advance in the last few years.

In 1900 Hamburg's merchant marine gave employment to 20,600 men, in round numbers, of whom only a part belonged to the State. Among these are 420 men who form the crews of the vessels engaged in the deep-sea fisheries. The last census states that 15,696 hands were engaged in ocean traffic and its dependent callings; 6,615 persons in inland navigation; and 5,722 in shipbuilding. The seagoing fishing smacks form no part of the merchant fleet. Hamburg's fishing fleet had, in 1900, 140 sailing vessels (Fischerewer) having a total of 4,384 registered tons, and 10 steamers which average 334 registered tons net space.

Hamburg's ocean vessels are divided among a large number of shippers, of whom the greater part employ only one ship, whose captain is himself the owner. This small business, which used to include the largest part of all the vessels, is being more and more crowded out by the large owners. There exists at the present time a sharp division between the shipping trade carried on by steamers and that by sailing vessels. Both forms of business are so essentially different that they can not thrive simultaneously under one management. There are in Hamburg 21 firms operating steamship lines (14 being joint-stock companies) and 15 firms operating sailing lines (2 being companies).

The most important of these firms is the great "Hamburg-Amerikanische-Packetfahrt-Actien-Gesellschaft," generally known as the "Hamburg-Amerika Line." This company was founded in 1847. Its first vessel, a sailing bark of 400 registered tons, with space for 200 passengers, was named the *Deutschland*. It wished in this way to give a decidedly German character to the nearly hopeless undertaking of making the passenger traffic to North America independent of England. The *Borussia*, the company's first steamer, made her maiden trip to New York in 1856. The company went entirely into the steamship business very shortly afterwards. The development of the line during the past few years is unprecedented. It owned, January 1, 1896, 51 seagoing steamers, with 179,599 registered tons; and on January 1, 1901, it had 98 steamers, with 486,528 registered tons, not to mention 15 others under construction with 98,600 registered tons, a part of which have since then gone into commission. To these 113 vessels, with 585,000 registered tons in round figures, must be added 136 auxiliary vessels (passenger boats on the Elbe, lighters, tugs, launches, and floating elevators) having in all about 30,050 registered tons.

Many firms and companies are devoted to the towboat service of the port of the Elbe, and of the North Sea. The most important of these is the Vereinigte Bugsir- und Frachtschiffahrtgesellschaft (United Towboat and Freight Navigation Company), with 19 sea tugs and 35 seagoing lighters. Several small tugs attend to the harbor service. Every large shipping house and every shipyard owns its own tugs. Several firms make a specialty of going to the assistance of stranded vessels and of raising sunken craft. The Hamburg shipyards are supplied plentifully with floating docks for taking out and repairing the vessels coming to the port.

### HAMBURG'S SHIPPING AND MERCHANDISE BUSINESS.

Hamburg has business relations with every country in the world. As its ships are to be met in all ports, so the merchant ships of all seafaring nations visit its port. Many are the routes which meet in the harbor of Hamburg. Here center great transoceanic lines from the most easterly shores of the Old World to the most westerly shores of the New; from the Arctic to the Antarctic regions; the shorter lines of ocean trips from the Black and Mediterranean Seas to the northern coasts of Russia and Finland; finally, the coasting trips within the limits of the seas which touch the shores of Germany; up the parts of rivers accessible to navigation, the Rhine (to Cologne), the Ems, the Weser, Oder, Vistula, and several smaller streams.

The many-branched waterway system of the Elbe, already mentioned, coming from the country, has at Hamburg the natural terminus of its inland navigation. This system now reaches all over east and middle Germany through its eastward canal connections, and it will, in all probability, ere long obtain further extended connections with the Rhine on the west and with the Danube on the south.

To these waterways must be joined the extensive network of railways which extends over the country tributary to Hamburg as far as Russia, Austro-Hungary, and the Danubian States, and which, in addition to the business with points in Germany, has built up an important through overland traffic between these countries and Hamburg.

TABLE I.—*Ocean traffic of the port of Hamburg.*

(*a*) NATIONALITY.

| | Average for 1871–1880. | | Average for 1881–1890. | | 1890. | | 1895. | | 1900. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | Registered tons. | No. | Registered tons. | No. | Registered tons. | No. | Registered tons. | No. | Registered tons. |
| NATIONALITY OF VESSELS ARRIVING. | | | | | | | | | | |
| Hamburg vessels | 891 | 577,464 | 1,510 | 1,285,925 | 2,035 | 1,905,873 | 2,489 | 2,282,429 | 3,690 | 3,409,224 |
| Other German vessels | 1,412 | 169,585 | 1,689 | 319,887 | 1,665 | 353,691 | 2,096 | 489,963 | 3,950 | 873,527 |
| Total | 2,303 | 747,049 | 3,199 | 1,605,812 | 3,700 | 2,259,654 | 4,585 | 2,772,392 | 7,640 | 4,282,751 |
| British | 2,268 | 1,173,408 | 2,646 | 1,776,261 | 3,053 | 2,348,393 | 3,337 | 2,822,363 | 3,442 | 2,779,688 |
| Norwegian | 234 | 87,456 | 331 | 165,978 | 414 | 207,999 | 427 | 222,607 | 529 | 325,669 |
| Dutch | 285 | 49,148 | 335 | 78,188 | 415 | 89,361 | 423 | 94,322 | 548 | 133,883 |
| Danish | 104 | 20,591 | 129 | 36,301 | 221 | 72,799 | 294 | 89,936 | 408 | 149,622 |
| French | 118 | 50,311 | 114 | 71,779 | 105 | 78,967 | 75 | 67,083 | 78 | 82,160 |
| Swedish | 93 | 24,594 | 117 | 39,070 | 127 | 47,684 | 156 | 65,334 | 267 | 91,673 |
| Belgium | 6 | 2,849 | 6 | 3,359 | 18 | 8,870 | 28 | 34,114 | 15 | 19,014 |
| Spanish | 19 | 7,767 | 80 | 57,124 | 69 | 58,029 | 43 | 34,293 | 49 | 56,620 |
| Russian | 10 | 3,775 | 10 | 5,016 | 7 | 4,789 | 35 | 21,564 | 67 | 47,127 |
| Italian | 24 | 11,673 | 28 | 15,452 | 18 | 9,675 | 23 | 15,583 | 28 | 25,241 |
| Greek | | | | | 6 | 8,086 | 2 | 4,467 | 13 | 20,282 |
| Austro-Hungarian | 4 | 1,931 | 5 | 2,301 | 5 | 2,369 | 12 | 8,783 | 14 | 22,801 |
| Portuguese | 4 | 1,002 | 3 | 1,415 | 3 | 4,470 | | | | |
| North American | 26 | 23,466 | 6 | 7,202 | | | 1 | 1,372 | | |
| All other | 4 | 1,234 | 6 | 4,789 | 5 | 1,770 | 2 | 280 | 4 | 983 |
| Total | 5,502 | 2,206,254 | 7,015 | 3,870,047 | 8,176 | 5,202,825 | 9,443 | 6,254,493 | 13,102 | 8,037,514 |

(*b*) COUNTRY OF ORIGIN.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| COUNTRIES FROM WHICH ARRIVING. | | | | | | | | | | |
| German ports | 1,254 | 124,330 | 1,625 | 232,916 | 1,954 | 347,053 | 2,847 | 572,874 | 4,683 | 713,975 |
| Great Britain | 1,539 | 764,792 | 2,054 | 1,257,899 | 2,248 | 1,445,010 | 2,273 | 1,421,681 | 2,398 | 1,456,397 |
| Great Britain (colliers) | 915 | 503,596 | 837 | 582,398 | 997 | 726,326 | 968 | 650,145 | 1,816 | 1,268,896 |
| Rest of Europe | 962 | 275,637 | 1,412 | 673,789 | 1,733 | 1,017,635 | 1,969 | 1,282,357 | 2,693 | 1,367,648 |
| America | 692 | 463,574 | 902 | 917,984 | 958 | 1,258,822 | 988 | 1,636,746 | 1,076 | 2,407,053 |
| Africa | 45 | 14,013 | 71 | 66,787 | 123 | 138,668 | 162 | 225,253 | 180 | 247,186 |
| Asia and Australia | 95 | 60,312 | 114 | 138,274 | 163 | 269,311 | 236 | 465,437 | 256 | 576,359 |
| Total | 5,502 | 2,206,254 | 7,015 | 3,870,047 | 8,176 | 5,202,825 | 9,443 | 6,254,493 | 13,102 | 8,037,514 |
| SUMMARY. | | | | | | | | | | |
| Sailing vessels | 2,648 | 516,330 | 2,414 | 611,546 | 2,272 | 587,938 | 2,597 | 694,896 | 4,169 | 797,529 |
| Steamers | 2,854 | 1,689,923 | 4,601 | 3,258,501 | 5,904 | 4,614,887 | 6,846 | 5,559,597 | 8,933 | 7,239,985 |
| Percentage: | | | | | | | | | | |
| Sailing vessels | 48.1 | 23.5 | 34.4 | 15.8 | 27.8 | 11.3 | 27.5 | 11.1 | 31.8 | 9.9 |
| Steamers | 51.9 | 76.5 | 65.6 | 84.2 | 72.2 | 88.7 | 72.5 | 88.9 | 68.2 | 90.1 |

Greatly as Hamburg's merchant fleet has increased in these latter years, it does only a part of the carrying trade of the port, in which nearly every nation with large seafaring interests has a share. Table I gives the shipping trade of the port of Hamburg, by averages for the two decades 1871–1880 and 1881–1890, and for the single years 1890, 1895, 1900. The first part (*a*) of this table shows this trade according to the nationality of the vessels, while the second part (*b*) shows the country from which the vessel's cargo was carried. It is seen by the first part that English vessels were far more numerous than those of any other State; and that even in 1895 Germany was still behind England in registered tonnage. In 1896 Germany's registered tonnage was for the first time greater than England's. The second part shows also that one-third of the merchandise from England is coal; the vessels which bring it return generally empty. It can be seen, too, that by far the larger part of the transportation of general and valuable goods is in German hands, and especially in those of Hamburgers. The table needs no further explanation; attention must be directed, however, to the fact that the very marked preponderance of the steam traffic (see percentages under *b*) arises, in the first place, from the greater number and larger capacity of the steamers, and, in the second place, from the greater number of trips which, by reason of their greater speed, they are able to make in the course of a year.

TABLE II.—*Hamburg steamship lines in 1900.*

| Number. | Steamship lines, where belonging. | Steamers. | | | |
|---|---|---|---|---|---|
| | | Number. | | Net space. | |
| | | Vessels. | Trips. | For all trips. | Average per trip. |
| | (*a*) European voyages: | | | *Reg. tons.* | *Reg. tons.* |
| 33 | Hamburg | 215 | 2,258 | 1,324,356 | 587 |
| 10 | Rest of Germany | 53 | 889 | 163,590 | 184 |
| 23 | Great Britain | 149 | 2,101 | 1,231,762 | 586 |
| 20 | Remaining foreign countries | 128 | 1,065 | 484,685 | 455 |
| 86 | Total | 545 | 6,313 | 3,204,393 | 508 |
| | (*b*) Voyages outside of Europe: | | | | |
| 23 | Hamburg | 300 | 706 | 1,966,840 | 2,786 |
| 5 | Rest of Germany | 47 | 79 | 157,417 | 1,993 |
| 4 | Great Britain | 57 | 115 | 191,754 | 1,667 |
| ..... | Remaining foreign countries | ..... | ..... | ..... | ..... |
| 32 | Total | 404 | 900 | 2,316,011 | 2,573 |
| 118 | Aggregate | 949 | 7,213 | 5,520,404 | 765 |
| 71 | German | 615 | 3,932 | 3,612,203 | 919 |

Table II, which gives for 1900 the number and extent of the established and regular lines of ocean steamers which belong to Hamburg in comparison with those whose vessels merely call there, serves to explain further Hamburg's share in the overseas traffic. This table shows especially the great preponderance of Hamburg's enterprises of this sort relatively to those of England and of the rest of Germany in directions outside of Europe. For trips within Europe, England is far ahead in the possession of the lines between English ports and Hamburg. The other nations are unimportant or else have a share in the European trips only to their own ports.

Table III furnishes particulars as to the use of the quay equipment of the port. It shows how the business at the quays has, in the course of years, increased correspondingly to the total business of the port.

TABLE III.—*Use made of the quay equipment by ocean vessels.*

| Nationality. | Average for 1871–1880. | | Average for 1881–1890. | | 1890. | | 1895. | | 1900. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. | Registered tons. | No. | Registered tons. | No. | Registered tons. | No. | Registered tons. | No. | Registered tons. |
| German | 325 | 254,701 | 856 | 765,571 | 1,026 | 823,015 | 1,479 | 1,761,481 | 2,021 | 2,696,829 |
| British | 942 | 563,829 | 1,401 | 937,969 | 1,640 | 1,087,971 | 1,734 | 1,282,490 | 1,882 | 1,306,194 |
| Norwegian | 17 | 7,550 | 68 | 34,195 | 100 | 52,826 | 250 | 123,222 | 269 | 154,197 |
| Dutch | 97 | 27,671 | 177 | 60,712 | 199 | 68,651 | 228 | 74,417 | 277 | 75,303 |
| Danish | 0.4 | 231 | 17 | 7,553 | 98 | 45,559 | 154 | 53,697 | 197 | 55,218 |
| French | 70 | 37,271 | 88 | 58,231 | 93 | 61,823 | 64 | 58,027 | 69 | 68,890 |
| Swedish | 32 | 7,375 | 56 | 20,116 | 60 | 28,488 | 66 | 34,120 | 101 | 47,238 |
| Spanish | 8 | 4,828 | 68 | 45,932 | 68 | 47,730 | 38 | 26,597 | 44 | 41,500 |
| Russian | 0.2 | 85 | 0.3 | 139 | 2 | 1,233 | 1 | 786 | 3 | 2,530 |
| All others | 4 | 2,116 | 2 | 1,374 | 3 | 4.470 | 1 | 1,845 | 2 | 2,215 |
| Total | 1,496 | 905,657 | 2,733 | 1,931,792 | 3,289 | 2,221,766 | 4,015 | 3,416,682 | 4,865 | 4,450,114 |
| Steamers | 1,490 | 904,702 | 2,702 | 1,929,751 | 3,228 | 2,216,407 | 3,835 | 3,383,037 | 4,505 | 4,386,395 |
| Sailing vessels | 6 | 955 | 31 | 2,041 | 61 | 5,359 | 180 | 33,645 | 360 | 63,719 |
| Percentage: | | | | | | | | | | |
| Steamers | 99.6 | 99.9 | 98.9 | 99.9 | 98.1 | 99.8 | 95.5 | 99.0 | 92.6 | 98.6 |
| Sailing vessels | 0.4 | 0.1 | 1.1 | 0.1 | 1.9 | 0.2 | 4.5 | 1.0 | 7.4 | 1.4 |

The following proportionate figures may be stated in the matter of the use of the quays in 1900. Of the 13,102 seagoing vessels which came to Hamburg in 1900, 4,865, or 37 per cent, made use of the quay equipment. According to this (for 15,500 meters of useful quay length) 0.314 of a vessel frequents 1 linear meter of quay; or, assuming the average length of a vessel to be 100 meters, every meter of quay length serves for 31.4 length of vessel; that is, assuming the entire length of the quays to be fully occupied during the whole course of the year, the vessels lying by them must have been changed thirty-one times, giving eleven to twelve days for the time of each ship. Naturally such a distribution does not occur. At certain times the quays are fully occupied, and at other times a part of them lies idle.

Table IV gives a clear statement of the traffic by river vessels between Hamburg and the upper Elbe. The number of upper Elbe vessels was nearly four times as great in 1900 as was the yearly average of the decade 1861–1870, and their carrying capacity was nearly nine times as great. The average capacity of the Elbe barges has therefore more than doubled. The utilization of the capacity of the Elbe craft on the down trip has fallen from 61 per cent in round numbers to 57 per cent, whereas on the up trip it has risen from 69 per cent to 76 per cent. Formerly the out and in movement between Hamburg and the upper Elbe was about the same each way; now the traffic going inland is very much the greater. Nevertheless, the upper Elbe vessels render excellent service in both directions. The river business of Hamburg is exceeded in Germany only by the water traffic of Ruhrart-Duisburg, but it must be remembered that by far the largest part of the business of these two inland ports lies exclusively in coal shipments. In Hamburg, on the other hand, valuable merchandise forms a very large part of the cargoes to and from the upper Elbe.

TABLE IV.—*Movement of upper Elbe vessels at Hamburg.*

| Character. | Average of— | | | 1890. | 1895. | 1900. |
|---|---|---|---|---|---|---|
| | 1861–1870. | 1871–1880. | 1881–1890. | | | |
| (*a*) River vessels arriving from the upper Elbe: | | | | | | |
| Sailing vessels.....number.. | 3,813 | 3,561 | 4,233 | 4,312 | 4,007 | 4,628 |
| Steamboats.....do.... | 575 | 1,511 | 3,003 | 3,518 | 3,802 | 4,493 |
| Towboats.....do.... | 578 | 921 | 3,475 | 4,639 | 6,301 | 9,593 |
| Rafts.....do.... | 146 | 88 | 72 | 63 | 25 | 26 |
| Total.....do.... | 5,112 | 6,081 | 10,783 | 12,532 | 14,135 | 18.740 |
| Total capacity.....tons[a].. | 525,785 | 777,150 | 1,889,141 | 2,401,401 | 3,076,421 | 4,584,392 |
| Total goods brought...do.[a]... | 322,094 | 477,013 | 1,286,792 | 1,729,220 | 1,734,304 | 2,606,920 |
| (*b*) River vessels departing for the upper Elbe: | | | | | | |
| Sailing vessels.....number.. | 3,842 | 3,569 | 4,275 | 4,299 | 4,063 | 4,469 |
| Steamboats.....do.... | 575 | 1,507 | 2,986 | 3,476 | 3,802 | 4,476 |
| Towboats.....do.... | 570 | 907 | 3,426 | 4,493 | 6,485 | 9,572 |
| Total.....do.... | 4,987 | 5,983 | 10,687 | 12,268 | 14,350 | 18,517 |
| Total capacity.....tons[a].. | 491,613 | 759,677 | 1,879,216 | 2,342,109 | 3,143,286 | 4,567,205 |
| Total goods taken.....do.[a]... | 340,579 | 491,823 | 1,217,242 | 1,671,769 | 2,309,133 | 3,457,215 |

[a] Tons of 1,000 kilograms.

The weight and value of Hamburg's merchandise business, so far as the statistics thereof have been obtained, is set forth in Table V for the same years as those given in Table I. The table sets forth what came to and what went from Hamburg by sea and by land. The statement by land is not wholly complete, because no statistical information was gathered as to the forwarding of merchandise either by rail north via Altona, or by the lesser navigation to adjacent places on the south and lower Elbe, or yet by land and water conveyance within Hamburg and its nearest environs. These missing parts are unimportant in comparison with the quantity of traffic shown in the table. The steady and rapid development of Hamburg's business comes out very clearly. The quantity and value of the goods in and out, as may have been noticed already, have increased unprecedentedly during the last fifteen years; the quantity some thirteen to eighteen times, the value about seven to nine times. It is especially significant also for Germany's increasing domestic and industrial strength that the exports from Hamburg by sea show relatively the greatest growth. The figures in Table V speak an interesting and eloquent language, and it seems unnecessary to make any further comment thereon.

TABLE V.—*Hamburg's merchandise business.*

IMPORTS.

| Direction. | Average from 1871–1880. | | Average from 1881–1890. | | 1890. | |
|---|---|---|---|---|---|---|
| | Weight. | Value. | Weight. | Value. | Weight. | Value. |
| By sea from— | | | | | | |
| Extra-European countries | *Tons.a* 490,147 | $65,515,139 | *Tons.a* 1,029,500 | $105,894,551 | *Tons.a* 1,670,552 | $176,597,410 |
| Great Britain and Ireland | 1,358,674 | 118,395,429 | 1,787,684 | 104,621,970 | 2,184,777 | 100,673,475 |
| Rest of Europe | 253,422 | 34,727,947 | 678,720 | 50,927,450 | 1,151,638 | 66,961,305 |
| Total | 2,102,243 | 218,638,515 | 3,495,904 | 261,443,971 | 5,006,967 | 344,232,190 |
| By land— | | | | | | |
| By Lübeck-Hamburg Railway | 143,335 | 12,944,166 | 142,853 | 12,655,031 | 155,865 | 14,957,800 |
| By Berlin-Hamburg Railway | 281,027 | 76,127,844 | 286,526 | 78,862,191 | 386,950 | 107,410,820 |
| By Venlo-Hamburg Railway | 215,559 | 28,645,187 | 644,024 | 65,196,817 | 960,914 | 82,263,300 |
| From the upper Elbe | 477,013 | 22,911,288 | 1,286,792 | 69,100,961 | 1,729,220 | 96,667,712 |
| Total | 1,116,934 | 140,628,485 | 2,360,195 | 225,815,000 | 3,232,949 | 301,299,632 |

EXPORTS.

| Direction. | 1895. | | 1900. | |
|---|---|---|---|---|
| | Weight. | Value. | Weight. | Value. |
| By sea from— | *Tons.a* | | *Tons.a* | |
| Extra-European countries | 2,552,333 | $233,528,675 | 4,370,963 | $345,842,800 |
| Great Britain and Ireland | 2,072,651 | 100,026,135 | 3,642,684 | 113,588,005 |
| Rest of Europe | 1,744,052 | 81,803,465 | 1,836,968 | 110,769,820 |
| Total | 6,369,036 | 415,358,275 | 9,850,615 | 570,200,625 |
| By land— | | | | |
| By Lubeck-Hamburg Railway | 112,627 | 11,553,165 | 129,365 | 13,429,590 |
| By Berlin-Hamburg Railway | 401,935 | 109,888,327 | 517,810 | 121,449,377 |
| By Venlo-Hamburg Railway | 1,254,830 | 88,275,405 | 1,713,704 | 118,781,920 |
| From the upper Elbe | 1,734,304 | 88,081,573 | 2,606,920 | 127,215,950 |
| Total | 3,503,696 | 297,798,470 | 4,967,799 | 380,876,837 |

| Direction. | Average from 1871–1880. | | Average from 1881–1890. | | 1890. | |
|---|---|---|---|---|---|---|
| | Weight. | Value. | Weight. | Value. | Weight. | Value. |
| By sea to— | | | | | | |
| Extra-European countries | *Tons.a* 223,877 | (*b*) | *Tons.a* 701,863 | (*b*) | *Tons.a* 1,121,744 | $144,900,687 |
| Great Britain and Ireland | 512,345 | (*b*) | 800,224 | (*b*) | 798,366 | 93,338,745 |
| Rest of Europe | 232,210 | (*b*) | 498,051 | (*b*) | 592,220 | 76,879,440 |
| Total | 968,432 | $149,266,500 | 2,000,138 | $245,328,250 | 2,512,330 | 315,118,872 |
| By land— | | | | | | |
| By Lubeck-Hamburg Railway | 87,705 | (*b*) | 108,831 | (*b*) | 133,294 | 22,770,545 |
| By Berlin-Hamburg Railway | 327,914 | (*b*) | 261,956 | (*b*) | 341,859 | 74,097,597 |
| By Venlo-Hamburg Railway | 156,484 | (*b*) | 261,274 | (*b*) | 345,070 | 59,380,023 |
| By the upper Elbe | 491,823 | (*b*) | 1,217,242 | (*b*) | 1,671,769 | 105,124,920 |
| Total | 1,063,926 | 204,481,750 | 1,849,303 | 201,465,000 | 2,491,992 | 261,373,085 |

*a* Tons of 1,000 kilograms.
*b* Only the total value of the exportations has been obtained.

TABLE V.—*Hamburg's merchandise business*—Continued.

EXPORTS—Continued.

| Direction. | 1895. | | 1900. | |
|---|---|---|---|---|
| | Weight. | Value. | Weight. | Value. |
| By sea to— | *Tons.a* | | *Tons.a* | |
| Extra-European countries | 1,238,073 | $149,628,312 | 1,910,998 | $195,741,675 |
| Great Britain and Ireland | 968,599 | 97,854,065 | 1,089,588 | 108,807,422 |
| Rest of Europe | 771,193 | 86,710,945 | 1,580,967 | 148,209,085 |
| Total | 2,977,865 | 334,193,322 | 4,581,553 | 452,758,182 |
| By land— | | | | |
| By Lubeck-Hamburg Railway | 152,407 | 20,967,000 | 201,578 | 20,126,762 |
| By Berlin-Hamburg Railway | 369,812 | 84,804,795 | 549,621 | 97,265,333 |
| By Venlo-Hamburg Railway | 336,579 | 54,409,595 | 555,215 | 75,832,852 |
| By the upper Elbe | 2,309,133 | 122,249,440 | 3,457,215 | 176,375,525 |
| Total | 3,167,931 | 282,430,830 | 4,763,629 | 369,600,472 |

*a* Tons of 1,000 kilograms.

NOTE.—In the above table the value of the dollar is taken as 4 marks, for facility of calculation.

But Hamburg's importance as a world's center of commerce and its place as the business metropolis of Germany are clearly shown by this brief glance at its navigation and trade. A sound and vigorous member of that strong young organism, the newly unified German Empire, she has grown with the latter, and in her centuries-old rich past she has gathered strength for an unexpected growth. Proudly bears the Elbe upon its surface its costly load of vessels and goods, and in the spacious port of Hamburg, where are found all the appliances which the technical skill of the day can give, the exchange of the riches of all nations is made in amounts of which the earlier peoples never dreamed.

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# QUESTIONS SHOWING THE SCOPE OF THE WORK OF THE NATIONAL WATERWAYS COMMISSION, INCLUDING INQUIRIES TRANSMITTED TO CONSULAR AND ENGINEER OFFICERS OF THE UNITED STATES.

## QUESTIONS TO BE CONSIDERED BY SUBCOMMITTEES OF THE NATIONAL WATERWAYS COMMISSION.

JULY 16, 1909.

1. Relation between waterway and railway transportation, including terminals and transfers, competition, intercorporate relationships, and joint tariffs.

2. Canals, including advisability and desirability of canals for deep-draft vessels. Distinction between short canals connecting large bodies of water, such as the Soo or Panama, and long artificial waterways like the Erie Canal and the canals of the Ohio Valley.

3. Method of making appropriations, including the proportional shares to be expended each year. Proper steps to be taken before the adoption of projects for improvement.

4. Appropriate division between appropriations by the Federal Government, on the one hand, and by States, minor political divisions, and individuals on the other.

5. Relation of waterway improvements to bank protection, flood and drought prevention, and irrigation.

6. Policy relating to harbors, including the ownership and control of wharves and docks.

7. Relation of waterway improvements to water power.

8. Methods in the improvement of rivers, including the construction of locks and dams.

9. Comparison of European and other foreign waterways with those of the United States, including questions of navigability, land and floating equipment, and tows; the question of the cooperation of rail and water lines, and a comparison of European and American transportation rates, both by land and by water.

10. Reasons for decline in inland waterway transportation.

11. Effect of forestation, as well as the influence of cultivation, increase of population, and growth of modern improvements upon the volume of streams, uniformity of flow, floods, etc.

12. The most desirable size and type of boats or barges, including methods of propulsion.

**QUESTIONS TRANSMITTED TO CONSULAR OFFICERS OF THE UNITED STATES BY THE DEPARTMENT OF STATE IN ACCORDANCE WITH THE REQUEST OF HON. T. E. BURTON, CHAIRMAN COMMITTEE ON RIVERS AND HARBORS, HOUSE OF REPRESENTATIVES, UNITED STATES.**

*Harbor and river improvements.*

DEPARTMENT OF STATE,
*Washington, May 8, 1903.*

*To the diplomatic and consular officers of the United States.*

GENTLEMEN: I append hereto a letter from Hon. Theodore E. Burton, chairman of the Committee on Rivers and Harbors of the House of Representatives, requesting certain information in regard to harbor and river improvements.

You will please prepare a report on the subject at your earliest convenience.

The questions accompanying the letter should be carefully answered.

I am, gentlemen, your obedient servant,

HERBERT H. D. PEIRCE,
*Third Assistant Secretary.*

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COMMITTEE ON RIVERS AND HARBORS,
HOUSE OF REPRESENTATIVES, WASHINGTON, D. C.,
*Cleveland, May 2, 1903.*

MY DEAR SIR: I inclose a list of questions for consuls relating to river and harbor improvements. I have already had some conversation with Mr. Emory and Mr. Loomis on this subject, and also for a few minutes with you.

A few of these questions, involving a large amount of statistical detail, have been suggested by the Chief of Engineers of the War Department. I somewhat fear that the task of replying to all the interrogatories will be difficult. At the same time, the subjects with reference to which information is sought have become very important, and it is desirable, if too great a burden will not be imposed, to have complete answers to all these questions.

I should be very glad if the questions could be forwarded to the consuls at an early date, as in the three or four months, beginning June 1, I shall probably call on a considerable number of the consular officers, and if any information could be furnished by them orally it would be of great value to me and to others who are investigating the subjects referred to in the questions.

Very respectfully, yours, T. E. BURTON.

Hon. JOHN HAY,
*Secretary of State, Washington, D. C.*

*Questions relating to river and harbor improvements to be answered by consular officers.*

1. In what manner is the cost of river and harbor improvements provided? This question may be made clearer by designating several inquiries naturally included in its scope:

(*a*) Are improvements made by the government or by private corportations and individuals?

(*b*) Is there any apportionment of the cost between the central government and localities or individuals immediately or exceptionally benefited?

(*c*) If there is such apportionment, what is the usual proportion?

(*d*) Is the expense, or any portion of it, paid by tonnage or port dues? Is there any relation between such dues and the expense of the improvements made?

(*e*) When improvements of projects are promoted locally in the respective ports, to what extent are they improved by municipalities and by private corporations or individuals?

(*f*) Are tolls charged upon traffic upon canals or canalized rivers? If so, are the amounts so collected expended in waterway improvements, or are they paid into the general treasury?

(*g*) Are the works, when executed by the government, carried out usually by contract or by hired labor.

(*h*) If carried out by contract, what is the method of letting the contract?

2. In case improvements are made in harbors, to what extent does the government or other agency making the improvements also construct, as part of the improvement, docks, wharves, or terminals for freight?

3. What is the navigable depth, at mean low water, of the leading harbors and the range of tide in the same?

4. What is the navigable length and the channel depths and widths at mean low water of the principal rivers and canals?

5. Can you state the increase, respectively, in recent years of freight carried by railways and inland waterways, and what is the proportion carried by each at this time?

6. (*a*) What are the comparative rates for the carriage of freight by railway and by inland waterways?

(*b*) State, if practicable, with illustration, what the influence of the improved waterway has been upon the freight charges for land carriage.

7. What is the apparent tendency as regards further development of inland waterways by canalization of rivers and the construction of canals?

8. (*a*) What is the approximate amount of money expended to date in the respective countries for the improvement, construction, maintenance, and repair of rivers, harbors, and canals?

(*b*) Of the total amount expended for all purposes, how much was for work of improvement and construction, exclusive of that for maintenance and repair?

(*c*) Of the total amount expended for all purposes, how much was spent in operating and keeping in repair canals, locks, and dams, and what is the present annual cost of such work?

(*d*) In giving answers to paragraphs *a*, *b*, and *c* of question No. 8, it is desirable that the information be given, so far as possible, for individual works, as well as en bloc for the whole country in question.

9. Are there statistics given by public documents, or otherwise, stating the tonnage handled in or on the different ports, rivers, and canals, and the value of such tonnage?

10. (*a*) What is the length and depth at mean low water of each canal, (*b*) the number of locks and dams in each canal or canalized river, (*c*) the available length, the available width, and the depth on sills of each lock, (*d*) the kind of material used in construction, (*e*) and the approximate cost of each structure?

11. What is the nature of the engineering work carried on at each particular improvement?

It should be borne in mind that the Special Consular Reports on Canals and Irrigation in Foreign Countries, published at the Government Printing Office in 1898, is at hand, and it is unnecessary to duplicate statements made in that.

NOTE.—The reports of consular officers, printed as documents of the National Waterways Commission, were made in response to the above questions.

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## LIST OF QUESTIONS PREPARED BY THE NATIONAL WATERWAYS COMMISSION AND RECENTLY TRANSMITTED TO DIVERS CONSULAR OFFICERS.

*Questions for consular officers in Europe, to follow letter from the State Department.*

It is the intention of the members of the National Waterways Commission to visit Europe during the months of August and September for an examination of European waterways, and answers to the subjoined questions will be highly appreciated. It is hoped that the reports may be ready within about thirty days from the receipt of this letter from the commission, so that they may be transmitted to such address as will be hereafter designated. The uncertainty about the date of the adjournment of Congress makes it impossible to state definitely when the visit will be made. It is desired that the reports pertain to the localities in which the respective consuls are located, though, of course, material of a general nature will be useful.

The investigations of the commission will be almost exclusively confined to inland waterways, and no reports upon harbors, save as places for the loading and unloading of river and canal traffic, need be made.

1. How is the expense of improvement provided, both for original construction and for maintenance? Is it by the central government, by the constituent states or subdivisions, by localities immediately affected, or is it by a combination of the three? A statement of total expenditures for the respective improvements, including cost of annual maintenance, would be valuable.

2. Are there tolls or other charges for the use of waterways?

3. Is the amount of water-borne traffic increasing or diminishing?

4. What waterway improvements are under way or in contemplation, and what is the probable cost?

5. What commodities are most carried upon rivers or canals?

6. What are the rates on several specific commodities between localities to be specified, and how do these rates compare with the rates of carriage by rail?

7. What is the prevailing width and depth of waterways and canals?

8. What is the type, size, and draft of boats used? Is the tendency toward the substitution of the barge for the single boat, or the single boat for the barge?

9. What are the methods for the propulsion of boats?

10. What terminals are there for the loading or unloading of freight, and how are the terminals provided?

11. Is there any method for the transfer or interchange of freight between waterways and railways?

12. Is there any utilization of water power in connection with locks or other incidents of navigation?

13. What is the usual annual variation between high and low water, and at what seasons of the year is the water higher or lower.

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## QUESTIONS SUBMITTED BY THE DEPARTMENT OF COMMERCE AND LABOR THROUGH THE DEPARTMENT OF STATE.

*Tentative interrogatories for proposed inquiry by the Department of State on rivers and canals in foreign countries.*

Specific information, not general statement, is desired in answer to these questions. Every summary statement should be supported by evidence.

### I.—PUBLIC SUPERVISION.

(*a*) State what public authority, national, state, or local, exercises supervision in the different instances over navigable streams and canals.

(*b*) What are the powers and duties of such officials in regard to the following:

(3) Capitalization of navigation corporations.
Regulation of freight rates.
Reports of operation.
Maintenance and improvement of channels, docks, and terminal facilities.

(4) Collection of statistics of water-borne traffic, and by what agencies such statistics are complied and published.

### II.—WATERWAY IMPROVEMENTS.

(*a*) Is there any established policy as to water powers developed by works constructed for improving navigation? Give illustrations.

(*d*) To what general extent have river improvements and the construction of canals been carried on by the central government, by local governments, and by private enterprise? Give typical and important illustrations of each. Describe any system of cooperation and contribution between the central government and local government in such works.

(*g*) If possible, send photographs of important works and of terminal facilities, with available maps of terminals.

### III.—FLOATING EQUIPMENT.

(*a*) What is the general character of vessels used on rivers and canals?

(1) The relative use of self-propelled vessels and towed vessels.

(2) Motive power for barges and canal boats.

(3) Size and draft of vessels.

(4) The use of iron, steel, and wood in vessel construction.

(5) The cost of various types of boats.

(6) The use of special types of boats for particular cargoes and on different classes of waterways.

(7) The size of fleets of barges.

(8) Is the type of boats adapted to low-water stages, or are they constructed with a view to utilization in high water?

In each case specific information is desired showing the situation in typical instances rather than general statements of a summary character.

(*b*) Send photographs of special types of canal boats and river boats.

### IV.—OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

(*a*) Do canal companies or other waterway improvement companies own and operate vessels? Give examples.

(*c*) Are there important cases of consolidation of vessel owners into large corporations operating extensive fleets on inland waterways?

(*d*) To what extent are vessels owned and operated by railroads, or by producing and distributing concerns, such as coal, oil, lumber, ore, etc., fleets? Give examples.

(*e*) Are there any fleets of merchant vessels owned and operated by public authorities? Give examples.

(*g*) Are there important instances of combinations or monopolies controlling towing on canals and rivers? Give examples.

### V.—TERMINAL FACILITIES.

(*a*) What are the important or striking physical features of river and canal terminals, such as docks, wharves, piers, and floating wharf boats? Give illustrations and send photographs with this answer.

(*b*) Describe the most advanced methods of loading and unloading vessels on inland waterways, including the use of mechanical appliances.

(*d*) Are railroad tracks located on terminals of inland waterways, permitting direct transfer between railroad and water lines? Do such railroad tracks form a belt railroad, connecting all the railroads at a given port? Give examples.

(*e*) Are river and canal terminals owned by public or private interests? Are they owned at all by private railways? If so, give the important instances.

(*f*) Send copy of any public list of dockage fees and other terminal charges.

VI.—TOLLS AND FREIGHT RATES.

(*a*) Are tolls charged on canals and rivers? If so, what elements are considered in framing them and what service do they cover? Are there separate tolls for boats and cargo? Give typical illustrations.

(*b*) What elements enter into the making of towing rates on canals and rivers? Give illustrations of towing charges and send copies of any tariffs or towing rates.

(*c*) Do inland water lines have regular schedules of freight rates and classifications of freight? Are the rates stable or do they vary frequently with traffic exigencies? Give illustrations.

(*d*) How are inland waterway rates affected by—

(1) Distance of haul?
(2) Quantity of commodity offered?
(3) Speed?
(4) Character of commodity?

Give illustrations on important waterways.

(*e*) Do prorating arrangements exist between water lines and railroads, and to what extent? Give illustrations and send copies of joint rail and water tariffs.

(*f*) How do inland water rates affect railroad freight rates? Are railroad freight rates to water competitive points higher than to interior nonwater points of similar distances? Give illustrations.

Compare inland water rates with paralleling railway rates for short and for long distances, giving specific illustrations which shall show whether waterways have greater competitive power in the one case than in the other.

(*g*) What is the general attitude of rail and water lines toward each other? Is there active competition or are there agreements for the division of traffic? Give examples.

(*h*) Is there any legislation regulating the relations between rail and inland waterway systems of transportation? Is there any governmental restriction on the lowering of rail rates in competition with water rates? Give examples.

(*j*) Is it customary for shippers of goods by inland waterways to insure them, or is the risk assumed by the carrier? To what extent does this affect the freight rate? Give examples.

VII.—WATER-BORNE TRAFFIC.

(*a*) What is the general character of traffic on inland waterways: The principal commodities moved, the proportion and character of traffic moved in different directions, relative importance of package and bulk freight, etc. (This should be answered specifically for different waterways.)

(*b*) Send official publications giving, for the last ten years, available statistics of vessel movement and traffic carried on inland waterways; also railroad traffic, tonnage, and ton-mileage.

(*c*) Taking important inland water routes, does local traffic or other traffic predominate, and in what general proportion?

(*d*) Give a concise statement of typical conditions of labor which is employed in navigation and in terminal handling, particularly with reference to wages paid.

NOTE.—The above questions were revised by the members of the National Waterways Commission.

## QUESTIONS PREPARED BY THE NATIONAL WATERWAYS COMMISSION RELATING TO FOREIGN RAILWAY RATES.

*Tentative questions for proposed inquiry by the Department of State concerning railway rates in foreign countries.*

(In answering the following questions select typical illustrations, being careful to include all the data called for. If it is necessary to use any technical term not employed in American railway transportation, such term should be fully explained. Give statistics in denominations and units of the country under discussion. Do not convert into American denominations. Accuracy and precision are absolutely essential. Any peculiar or exceptional conditions should be fully explained.)

I. Give ten examples of rates on coal on different railway lines for different distances, with the following details:

(*a*) Give termini for each shipment.

(*b*) Give distances of each shipment, including in the list of ten rates at least three rates for the maximum distance that coal is shipped.

(*c*) Give separately the terminal and transportation charge. (If this is not possible, make note of the fact that the two are combined.)

(*d*) State what service is covered by the terminal charge.

(*e*) State the class of rate into which the coal traffic falls; that is, whether the rate is a special or commodity rate or a normal class rate, and if the latter, what class.

(*f*) Give all other facts concerning method of shipment which affect the rate, such, for example, as minimum carload weight or minimum train load, open or closed cars, fast or slow freight, and the like.

(*g*) If any of these rates have been given to encourage the development of any industry, state the facts.

II. Answer the above seven questions (*a* to *g*), quoting in each case ten examples of rates on different railway lines for different distances for the following commodities:

1. Iron ore.
2. Stone.
3. Lumber.
4. Fertilizers.
5. Grain.

III. Give ten illustrations of special rates granted to export business on different railways for different distances, and answer in each case the questions propounded above for the coal traffic (*a* to *g*) so far as they are applicable to the export business. Make a statistical tabulation comparing these export rates with local rates between the same termini.

IV. Give ten illustrations of rates charged by different railways for different distances on the highest grade of classified freight, that which, in many countries, corresponds to the express business of the United State, and answer in each case the questions propounded for the coal traffic (*a* to *g*).

V. Give ten illustrations of rates charged by different railways for different distances on typical products included in the various categories of the regular freight classification, showing both carload and

less than carload rates, and answer in each case the questions propounded for the coal traffic (*a* to *g*).

VI. Are the freight rates based absolutely on distance, or is the rate per ton-mile less for longer distances? Show, in the case of different commodities, at what distances the fall in the rate per ton-mile takes place.

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**QUESTIONS SUBMITTED TO THE ENGINEER CORPS, UNITED STATES ARMY.**

JULY 9, 1909.

MY DEAR GENERAL: In pursuance of our conversation this morning, I submit the following questions which I should be very glad to have answered by some of your subordinates:

1. Mississippi River, three divisions separate—mouth to Cairo, mouth of Ohio to mouth of Missouri, mouth of the Missouri to St. Paul or Minneapolis.

It is desired that the answers be given by years for the longest possible period.

(*a*) Depth and width of available channel.

(*b*) Kind of improvements used to promote navigation.

(*c*) Cost of such improvements.

(*d*) Aggregate tonnage.

(*e*) General statement of the different classes of commodities making up the aggregate tonnage.

(*f*) Variation or oscillation in height of water at typical localities on the section or stream under discussion.

(*g*) It is desired that freight rates on typical routes be given as far as possible. Also, are these rates increasing or diminishing?

It is, of course, desirable to know the tendencies. For instance, on the upper Mississippi the shipment of logs and rafts has greatly diminished.

It is also desired that the same questions be answered for the Ohio River, for the Hudson, the Connecticut, and the James. It is especially desired that the quantity of coal passing the locks at Louisville and the Davis Island dam on the Ohio River be given. If the quantity shipped to Cincinnati or other cities can be stated it would be desirable to have it.

As regards smaller streams, such as the Santee, the Savannah, the Illinois, I should be glad if you would have the engineering officers prepare a concise history of the navigation on those streams, answering practically the same questions as above set forth, but less in detail. What is desired in the case of smaller streams is a general sketch showing the history of navigation on the respective waterways in question.

I am told that Mr. Jacobson, of the Bureau of Statistics, has many of these figures, derived either from Engineers' Reports or from statistics of traffic furnished by commercial bodies, etc.

Very respectfully, yours,

T. E. BURTON,
*Chairman, National Waterways Commission.*

Brig. Gen. W. L. MARSHALL,
*Chief of Engineers, U. S. Army,*
*War Department, City.*

O

# EUROPEAN WATERWAYS.

## REPORTS OF CONSULAR OFFICERS OF THE UNITED STATES, LOCATED IN GERMANY, AUSTRIA-HUNGARY, FRANCE, BELGIUM, AND THE NETHERLANDS, ON RIVER AND HARBOR IMPROVEMENTS IN THEIR RESPECTIVE DISTRICTS.

(The reports contained herein were made in response to the questions included in the following circular of the Department of State, although each contains a considerable amount of general matter.)

### HARBOR AND RIVER IMPROVEMENTS.

DEPARTMENT OF STATE,
*Washington, May 8, 1903.*

*To the diplomatic and consular officers of the United States.*

GENTLEMEN: I append hereto a letter from Hon. Theodore E. Burton, chairman of the Committee on Rivers and Harbors of the House of Representatives, requesting certain information in regard to harbor and river improvements.

You will please prepare a report on the subject at your earliest convenience.

The questions accompanying the letter should be carefully answered.

I am, gentlemen, your obedient servant,

HERBERT H. D. PEIRCE,
*Third Assistant Secretary.*

---

COMMITTEE ON RIVERS AND HARBORS,
HOUSE OF REPRESENTATIVES, WASHINGTON, D. C.

CLEVELAND, *May 2, 1903.*

Hon. JOHN HAY,
*Secretary of State, Washington, D. C.*

MY DEAR SIR: I inclose a list of questions for consuls relating to river and harbor improvements. I have already had some conversation with Mr. Emory and Mr. Loomis on this subject, and also for a few minutes with you.

A few of these questions, involving a large amount of statistical detail, have been suggested by the Chief of Engineers of the War Department. I somewhat fear that the task of replying to all the interrogatories will be difficult. At the same time, the subjects with

reference to which information is sought have become very important, and it is desirable, if too great a burden will not be imposed, to have complete answers to all these questions.

I should be very glad if the questions could be forwarded to the consuls at an early date, as in the three or four months beginning June 1 I shall probably call on a considerable number of the consular officers, and if any information could be furnished by them orally it would be of great value to me and to others who are investigating the subjects referred to in the questions.

Very respectfully, yours,

T. E. BURTON.

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QUESTIONS RELATING TO RIVER AND HARBOR IMPROVEMENTS TO BE ANSWERED BY CONSULAR OFFICERS.

1. In what manner is the cost of river and harbor improvements provided? This question may be made clearer by designating several inquiries naturally included in its scope:

(*a*) Are improvements made by the government or by private corporations and individuals?

(*b*) Is there any apportionment of the cost between the central government and localities or individuals immediately or exceptionally benefited?

(*c*) If there is such apportionment, what is the usual proportion?

(*d*) Is the expense, or any portion of it, paid by tonnage or port dues? Is there any relation between such dues and the expense of improvements made?

(*e*) When improvements of projects are promoted locally in the respective ports, to what extent are they improved by municipalities and by private corporations or individuals?

(*f*) Are tolls charged upon traffic upon canals or canalized rivers? If so, are the amounts so collected expended in waterway improvements, or are they paid into the general treasury?

(*g*) Are the works, when executed by the government, carried out usually by contract or by hired labor?

(*h*) If carried out by contract, what is the method of letting the contract?

2. In case improvements are made in harbors, to what extent does the government or other agency making the improvements also construct, as part of the improvement, docks, wharves, or terminals for freight?

3. What is the navigable depth, at mean low water, of the leading harbors and the range of tide in the same?

4. What is the navigable length and the channel depths and widths at mean low water of the principal rivers and canals?

5. Can you state the increase, respectively, in recent years of freight carried by railways and inland waterways, and what is the proportion carried by each at this time?

6. (*a*) What are the comparative rates for the carriage of freight by railway and by inland waterways?

(*b*) State, if practicable, with illustration, what the influence of the improved waterways has been upon the freight charges for land carriage.

7. What is the apparent tendency as regards further development of inland waterways by canalization of rivers and the construction of canals?

8. (*a*) What is the approximate amount of money expended to date in the respective countries for the improvement, construction, maintenance, and repair of rivers, harbors, and canals?

(*b*) Of the total amount expended for all purposes, how much was for work of improvement and construction, exclusive of that for maintenance and repair?

(*c*) Of the total amount expended for all purposes, how much was spent in operating and keeping in repair canals, locks, and dams, and what is the present annual cost of such work?

(*d*) In giving answers to paragraphs *a*, *b*, and *c* of question No. 8, it is desirable that the information be given, so far as possible, for individual works, as well as *en bloc* for the whole country in question.

9. Are there statistics given by public documents, or otherwise, stating the tonnage handled in or on the different ports, rivers, and canals, and the value of such tonnage?

10. (*a*) What is the length and depth at mean low water of each canal, (*b*) the number of locks and dams in each canal or canalized river, (*c*) the available length, the available width, and the depth on sills of each lock, (*d*) the kind of material used in construction, (*e*) and the approximate cost of each structure?

11. What is the nature of the engineering work carried on at each particular improvement?

It should be borne in mind that the Special Consular Reports on Canals and Irrigation in Foreign Countries, published at the Government Printing Office in 1898, is at hand, and it is unnecessary to duplicate statements made in that.

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## HAMBURG, GERMANY.

CONSULATE-GENERAL OF THE UNITED STATES,
*September 19, 1903.*

Hon. FRANCIS B. LOOMIS,
*Assistant Secretary of State, Washington, D. C.*

SIR: In compliance with the department's circular instruction of May 8 last, transmitting copy of a letter from Hon. Theodore E. Burton, chairman of the Committee on Rivers and Harbors of the House of Representatives, I have the honor to transmit herein inclosed a report on "Harbor and River Improvements," with three subinclosures, covering the district of this office.

I further transmit a copy of the statistics, entitled "Hamburg's Commerce and Navigation" for the year 1902, as requested by Mr. Burton when in Hamburg.

I am, sir, your obedient servant,

E. H. L. MUMMENHOFF,
*Vice and Acting Consul-General.*

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### HARBOR AND RIVER IMPROVEMENTS.

1. The cost of river and harbor improvements in Hamburg is provided by the Hamburg state government. As to improvements of inland waterways, the expenses involved in this connection are not covered by any special taxes. With regard to harbor improvements and river improvements of benefit to sea navigation, the capital invested therein yields interest, so to say, by means of the receipts as indicated in paragraph "*d*."

(*a*) All improvements are made in Hamburg by the government exclusively.

(*b*) There is no apportionment as indicated in the question, as the Hamburg state government bears the entire cost.

(*d*) Seagoing vessels arriving in Hamburg pay a tonnage fee (Deklarations-Gebühr) of 12 pfennigs per cubic meter (2.856 cents per 35.315 cubic feet), net capacity. Modifications and exceptions are provided.

Vessels discharging cargo and loading directly alongside the pier or quays (not amid streams) are subject to extra fees (quay dues), according to special tariff.

Furthermore, all vessels entering the Elbe from the sea are subject to pilot dues, which are compulsory, part of these receipts being paid into the general treasury, and may thus be considered as a tax for the maintenance of light-houses, buoys, beacons, etc.

The quay dues charged are adequate to the disbursements for constructing walls, sheds, railroad tracks, cranes and derricks, so that the capital thus invested yields interest at a moderate rate.

(*e*) No answer necessary, because, as aforesaid, all costs are borne by the Hamburg state government.

(*f*) There are no tolls or similar dues charged to river craft. The custom-house receipts on imported goods are in no manner applied to expenses in connection with improvements of waterways.

(*g*) New works are generally carried out by contract. Work in connection with river regulations, maintenance of harbor improvements, quays, railroads alongside the quays, etc., as well as dredging, are executed by the government itself, by means of directly hired labor.

(*h*) If works are being carried out by contract, this is done through public bidding, the government accepting the most favorable and profitable offer.

2. In constructing new works in the harbor of Hamburg the improvements are entirely completed so as to be ready for use, including quay walls, sheds for merchandise, cranes and derricks, railroad tracks alongside the quays, terminals for freight, etc.

3. The navigable channel depth, at mean low water, of the Elbe at Hamburg is about 20 to 21 feet, at Cuxhaven (at the mouth of the Elbe) about 30 feet, and at the shallowest point between Hamburg and Cuxhaven at present 16 to 18 feet.

At mean low water the old harbors of Hamburg have a navigable depth of about 18 to 19½, the more recent ones about 21½ feet, and the most modern harbors about 26¼ feet. The harbors for river craft have a navigable depth of about 11½ feet. These figures indicate the depths in the several branches of Hamburg Harbor.

The range of tide in the harbor of Hamburg is about 6 to 8 feet, and at Cuxhaven about 10 to 12 feet.

The tide in the Elbe extends as far as Geesthacht, about 87 miles above Cuxhaven and 25 miles above Hamburg.

4. The following figures indicate the navigable lengths of the principal rivers and connecting canals in Germany.

| | Length of— | |
|---|---|---|
| | Canals. | Rivers |
| | *Miles.* | *Miles.* |
| 1. Vistula and east of Vistula | 102 | 49⅛ |
| 2. Between Vistula and Oder | 16½ | ..... |
| 3. Oder | 71⅛ | 104⅜ |
| 4. Between Oder and Elbe | 137¼ | 65½ |
| 5. Elbe | 246⅜ | 125½ |
| 6. Between Elbe and Weser | 2½ | ..... |
| 7. Weser | ..... | 17¼ |
| 8. Ems | 132 | 44½ |
| 9. Rhine | 261½ | 110¼ |
| 10. Between Rhine and Danube | 84⅜ | 25½ |
| 11. Danube | 3⅝ | ..... |

To these figures should be added the lengths of navigable, so-called "Torfkanäle," in the peat districts, and the artificial "Tiefen," also bays on mouths of rivers, to make up total length of navigable waterways in Germany, which is 2,498 miles.

*Maximal capacity of river craft admissible on German navigable waterways.*

| | Tons. |
|---|---|
| East Prussian waterways and Vistula | 200–250 |
| Oder | 375 |
| Spree | 400 |
| Elbe | 1,100 |
| Rhine, tow barges | 2,000–2,350 |
| Rhine, steamers | 975 |

The distance on the Elbe between Hamburg and Cuxhaven is about 63 miles. The width of the Elbe at Hamburg is about 400 meters (1,312 feet), at Brunsbüttel (mouth of the Kaiser Wilhelm Canal, about 16¼ miles above Cuxhaven) about 4,000 meters (2½ miles), and at Cuxhaven about 18,000 meters (11⅛ miles).

Figures indicating the depths of the Elbe are given in paragraph 3, but it may be mentioned that over the sand bars between Blankenese and the Luehe a channel depth of about 26 feet, at mean low water, is being dredged at present, and the work will be completed soon.

5. The information sought is given by statistics transmitted herewith as "Inclosure A."

Transportation of freight on German waterways amounts to about 25 per cent of the entire freight transportation in the German Empire.

6. (*a*) See statistics, "Inclosure B," giving comparative rates for the carriage of freight by railways and inland waterways from Hamburg to the principal places in Germany connected with Hamburg by railways as well as navigable waterways.

(*b*) The improved waterways have had no influence upon the freight charges for land carriage in Germany, the latter being governed by the freight tariff of the Royal Prussian railways, and there being very few private railway companies in existence in Germany.

7. There are no new canals or canalizations of rivers projected within the Hamburg consular district.

8. (*a* and *d*) During the period from 1871 to 1902 the Hamburg state government has expended in the interest of river navigation the following sums:

| | |
|---|---|
| For new works | $3,405,713 |
| For maintenance of river banks and appurtenances | 922,604 |
| For planting dikes and dams, etc | 18,638 |
| For dredging | 3,108,030 |
| For light-houses, buoys, beacons, etc | 20,533 |

The total amount expended in the interest of river navigation, which, however, is chiefly of benefit to seagoing vessels entering or clearing from the port of Hamburg, is about $35,700,000.

9. Statistics are issued by the statistical bureau of Hamburg with regard to Hamburg's commerce and navigation. There are also statistics issued by the imperial statistical bureau at Berlin, covering the entire Empire.

10. See inclosed statistics, "Inclosure C," giving dimensions of the Kaiser Wilhelm Canal and the Elbe Trave Canal.

11. The nature of engineering work carried on at the improvements on the Elbe by the Hamburg government is as follows: Spur dikes, longitudinal dikes, training walls, etc., but there are no locks and dams.

I further transmit a copy of the statistics, "Hamburg's Commerce and Navigation" for the year 1902, issued by the statistical bureau of Hamburg, as indicated in paragraph 9.

E. H. L. MUMMENHOFF,
*Vice and Acting Consul-General.*

CONSULATE-GENERAL OF THE UNITED STATES,
*Hamburg, Germany, September 19, 1903.*

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[Inclosure A.]

*Statistics showing weight and value of freight carried by railways and inland waterways to and from Hamburg.*

| To Hamburg— | Average 1891–1900. | 1899. | 1900. | 1901. |
|---|---|---|---|---|
| | *Tons.*[a] | *Tons.*[a] | *Tons.*[a] | *Tons.*[a] |
| By railways | 2,063,666 | 2,420,869 | 2,596,966 | 2,665,670 |
| On the Elbe | 2,233,386 | 2,678,984 | 2,867,612 | 2,822,167 |
| Total | 4,297,052 | 5,099,853 | 5,464,578 | 5,487,837 |

| To Hamburg— | Average 1891–1900. | 1899. | 1900. | 1901. |
|---|---|---|---|---|
| | *Dollars.* | *Dollars.* | *Dollars.* | *Dollars.* |
| By railways | 198,218,665 | 210,691,204 | 241,485,165 | 229,010,487 |
| On the Elbe | 97,225,304 | 107,921,923 | 121,109,584 | 113,111,796 |
| Total | 295,443,969 | 318,613,127 | 362,594,749 | 342,122,283 |

| From Hamburg— | Average 1891–1900. | 1899. | 1900. | 1901. |
|---|---|---|---|---|
| | *Tons.*[a] | *Tons.*[a] | *Tons.*[a] | *Tons.*[a] |
| By railways | 1,117,642 | 1,279,880 | 1,437,055 | 1,344,588 |
| On the Elbe | 2,920,115 | 3,865,519 | 3,802,936 | 3,838,935 |
| Total | 4,037,757 | 5,145,399 | 5,239,991 | 5,183,523 |

| From Hamburg— | Average 1891–1900. | 1899. | 1900. | 1901. |
|---|---|---|---|---|
| | *Dollars.* | *Dollars.* | *Dollars.* | *Dollars.* |
| By railways | 161,626,397 | 171,309,258 | 183,950,150 | 175,448,675 |
| On the Elbe | 132,229,377 | 164,261,103 | 167,909,500 | 157,473,725 |
| Total | 293,855,774 | 335,570,361 | 351,859,650 | 332,922,400 |

[a] Tons of 2,200 pounds.

*Traffic on the upper Elbe.*

| Average. | Arrivals in Hamburg. | Departures from Hamburg. |
|---|---|---|
| | *Tons.* | *Tons.* |
| 1881–1885 | 1,183,090 | 1,179,957 |
| 1886–1890 | 1,636,617 | 1,495,162 |
| 1891–1895 | 1,974,006 | 2,214,559 |
| 1896–1900 | 2,633,635 | 3,755,451 |

*Statistics showing traffic on German rivers and inland canals in 1899.*

| | Arrivals and departures. | Transit traffic. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Baltic rivers | 5,765,500 | 12,540,200 |
| Rivers and canals of the Marks | 6,265,150 | 8,859,980 |
| North Sea rivers (exclusive of the Rhine) | 7,217,390 | 12,938,560 |
| German Rhine | 26,355,170 | 16,430,060 |
| Bavarian waterways | 245,450 | 1,289,160 |
| German ports on Lake of Constance | 224,740 | ---------- |
| German Danube | 427,310 | 284,860 |
| Total | 46,500,710 | 52,342,820 |

[Inclosure B.]

*Comparative rates for freight carried by railways and inland waterways from Hamburg to the principal places in Germany connected with Hamburg by inland waterways.*

(*a*) By Rail.

[Rates per 220 pounds (100 kilos).]

| From Hamburg to— | Shipments less than 5,000 kilos. | | Shipments between 5,000 and 10,000 kilos. | | Shipments over 10,000 kilos. | | | |
|---|---|---|---|---|---|---|---|---|
| | Express goods (eilgut). | Ordinary goods. | Goods of the general carload class. | Goods of special tariff I. | Goods of the general carload class. | Goods of special tariff I. | Goods of special tariff II. | Goods of special tariff III. |
| Kiel | $0.65 | $0.32 | $0.22 | $0.16 | $0.19 | $0.15 | $0.12 | $0.08½ |
| Berlin | 1.41 | .70½ | .49 | .36 | .42½ | .33 | .26 | .17½ |
| Magdeburg | 1.29 | .64½ | .44½ | .33 | .39 | .30 | .24 | .16 |
| Dresden | 2.08½ | 1.04 | .78½ | .58 | .69 | .52½ | .41½ | .27 |
| Dusseldorf | 1.82 | .91 | .66 | .48½ | .57½ | .44 | .34½ | .23 |
| Cologne | 1.97 | .98½ | .73 | .54 | .64 | .48½ | .38½ | .25 |

(*b*) By Water.

| From Hamburg to— | For goods of all classes, shipments less than 5,000 kilos. | For goods of all classes, shipments over 5,000 kilos (according to class of goods and quantity). |
|---|---|---|
| Kiel | $0.19 | $0.16½–$0.09½ |
| Berlin | .14½ | .12 – .06 |
| Magdeburg | .09½ | .07 – .03½ |
| Dresden | .10¾ | .08½– .05½ |
| Duesseldorf | .28½ | .23¾– .16½ |
| Cologne | .28½ | .23¾– .16½ |

In shipping by water bulk articles, such as sugar, salt, manure salts, etc., the lowest rates of railway special tariff III are charged.

Special tariff I is applied on manufactures.

Special tariff II is applied on half manufactures.

Special tariff III is applied on cheap raw products and bulk articles.

These tariffs are those mentioned in connection with the rates given for railway transportation, forming part of the general freight tariff of the Royal Prussian railroads.

[Inclosure C.]

*Dimensions of the Elbe-Trave Canal and the Kaiser Wilhelm Canal.*

| | Elbe-Trave Canal. | Kaiser Wilhelm Canal. |
|---|---|---|
| Length | 28 miles | 54¾ miles. |
| Mean width of water level | 68 feet 10 inches [a]<br>164 feet [b] | 72 feet. |
| Mean water depth | 9 feet 10 inches | 29 feet 6 inches. |
| Locks, number | 7 | 2. [c] |
| Locks, length | 262 feet | 492 feet. |
| Locks, width | 39 feet 4 inches | 82 feet. |
| Locks, depth on sills | 8 feet 3 inches | 32 feet. |
| Annual traffic | 165,650 tons | 4,375,170 tons. [d] |

[a] Mean width of canal proper, 69 feet.
[b] Mean width of rivers connecting, 164 feet.
[c] Double locks.
[d] 1901, 4,198,754 registered tons.

## BAMBERG, GERMANY.

CONSULATE OF THE UNITED STATES,
*September 4, 1903.*

If I failed until now to send my report on "harbor and river improvements," as ordered in department's circular of May 8, it is not because I did not try to send this report sooner, but on account of untold difficulties I encountered in trying to get the proper data for the same. The only navigable waterway in this consular district is the Ludwigs Canal, built by the Bavarian Government in the years 1836 to 1846—the intention being to connect by the same the rivers Danube and Main. It commences near the city of Kehlheim, on the Danube, and it ends about a mile below this city, where the navigable part of the Main takes it up. Unfortunately, while the building of a canal which brought about a continuous waterway between the south and north was considered an immense improvement for trade and commerce even at such an early date, the mistake was made to build it on too small proportions, and not more than ten years after its opening it proved insufficient, whereas at the present time it is entirely inadequate. The public condemns the canal as antiquated and behind the times, and beyond a few ships, carrying building material of the cheapest kind, you hardly ever see any traffic on this canal, so that at the present time the cost of maintaining it by far exceeds the income derived from it.

The answers I send herein are, to the best of my knowledge, correct, but they can do little good in the way of offering a basis for building canals in the United States.

A number of prominent business men of the kingdom are petitioning the government now to rebuild the present useless waterway in a fashion to do justice to the requirements of trade and traffic of modern times. If the plan should be carried out as suggested, there would be a canal which would be of material help to shippers for cheaper freights and would considerably relieve the now overburdened railroads. The new plan proposes dimensions of depth and width, also of the locks, on a much larger basis, so that ships of 600 tons and more can travel on the canal. It will be a question of one of the next sessions of the legislature to decide if the improvements claimed by the

sponsors of the proposition are really large enough to justify the country to allow the heavy expense. With the depth and width of the new canal being figured on a scale at least double of the old one, with locks holding ships of four times the size of the present boats, with the waterway of the Danube being now better navigable than formerly, and that of the river Main being deepened now, it is expected that the new canal, when once in order, will be a great benefit to trade, and at the same time will be a source of revenue for the government, where it is now one of considerable loss.

Following are my answers to questions mentioned in above-named circular:

HARBOR AND RIVER IMPROVEMENTS.

1. (*a*) Improvements are made by the Government.

(*b*) Municipalities contribute only the ground required by the canal in their respective districts.

(*c*) There is not.

(*d*) The rate of tonnage is the same all over the canal, irrespective of more or less improvements.

(*e*) The improvements in the respective ports are assumed entirely by the Central Government.

(*f*) There are tolls charged on traffic. The tolls are paid into the general treasury.

(*g*) They are carried out by contract.

(*h*) Publication in the newspapers and awarding the contract to the lowest bidder.

2. The General Government assumes all charges.

3. The harbors I can report on are only canal harbors and not subject to tide. Depth in proportion to navigable possibility of canal.

4. The length of the present canal is 177 kilometers, or 110 miles. Channel depth is 1.46 meters, or about 59 inches; width, 15.76 meters, or 51 feet 7 inches.

5. The railways within the last five years have increased their carriage of freight nearly 50 per cent, whereas the canal I report about has decreased in the same proportion, owing to its inadequacy.

6. (*a*) The comparative rate for the carriage of freight by railways and canals is 11 to 5.

(*b*) In the absence of an improved waterway I can not answer this question.

7. The tendency is that there will be considerable development of inland waterways, so as to relieve by such the burden of freight carried by the railroads.

8. (*a*) The Ludwigs Canal cost to build 27,678,424 marks, or $6,587,461.91.

(*b*) Since 1859 there has been very little money spent for improvements or construction, but it is safe to say that repairs and maintenance cost about 1,000,000 marks, or $238,000, per annum.

(*c*) About one-third for locks, the rest for dams.

(*d*) It is impossible to obtain this specification here.

9. None in Bavaria.

10. (*a*) As stated above, this canal is 177 kilometers in length.

(*b*) The number of locks on that stretch is 101.

(*c*) The available length of locks is 34 meters, or 111½ feet; width, 4.64 meters, or 15½ feet; depth on sills, 1.46 meters, or 59 inches.

(*d*) The material used for the construction of the dams is granite blocks as about 8 inches square, and cement, the mason work of the locks being of the same material, only large blocks.

11. There being no improvement made, I can not tell cost.

W. Bardel,
*United States Consul.*

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### BERLIN, GERMANY.

Consulate-General of the United States,
*Berlin, Germany, July 22, 1903.*

Hon. Francis B. Loomis,
*Assistant Secretary of State, Washington, D. C.*

Sir: I have the honor to inclose herewith my report made in compliance with general instructions dated May 8, 1903, on the canals and navigable rivers in the district of Berlin.

In respect to the form and scope of this report, I have to state that before receiving the instruction of May 8 I received letters from Hon. Theodore E. Burton, chairman of the House Committee on Rivers and Harbors, by whom the instruction had been inspired, stating that he was then in France and would reach Berlin soon after the middle of July. Mr. Burton wrote quite fully as to the information he specially desired to obtain, and the examinations he desired to make in and about Berlin. I at once set to work collecting literature and information relating to the navigable waterways of this district, and on his arrival at Berlin, July 14, a systematic plan of operation was agreed upon. Mr. Burton is accompanied by Major Mahan, of the U. S. Corps of Engineers, who will make an elaborate technical report for the information of the Committee on Rivers and Harbors.

It was agreed that my report instead of following the interrogatories of the circular of May 8, which are for the most part general and relate to seaports and other subjects foreign to an inland consulate, should be descriptive and confined to the very important river and canal system of the Elbe-Oder-Spree-Havel region, which is substantially the consular district of Berlin.

I am, sir, very respectfully, your obedient servant,

Frank H. Mason,
*Consul-General.*

#### CANALS AND NAVIGABLE RIVERS IN THE DISTRICT OF BERLIN.

Germany is notable among European countries for the number, length, and symmetrical geographical distribution of her navigable rivers, and for the skill and enterprise with which these natural water courses have been deepened, improved, supplemented by lateral canals, and adapted by artificial means to the requirements of inland transportation. The Weichsel, which flows from Warsaw to the Baltic, with Königsberg and Danzig as its seaports, the Oder, with the Warthe as an affluent, debouching in the great harbor at Stettin;

the Spree and Havel, which, with their network of canals reaching to the Elbe and Oder, have made possible the building and prosperity of Berlin; the Elbe, bringing the commerce of Saxony, Magdeburg, and all central Germany down to Hamburg; the Weser, which makes a vast area of west central Germany tributary to Bremen, and the Rhine, with its branches, the navigable Main, the Ems and Mosel, threading the whole western portion of the Empire, these are gifts of nature which have been most potent in the industrial and commercial development of the Fatherland.

As early as 1875, five years after the consolidation of the Empire, Germany had in service 5,625 miles of inland waterways on which were carried during that year 10,400,000 tons of incoming and 9,200,000 tons of outgoing freight, the total service being reckoned at 2,754,000,000 ton-kilometers. In 1900 the length of navigable waterways had been increased to 9,450 kilometers (5,906 miles) and the traffic had grown to 40,400,000 tons of arriving and 31,800,000 tons of departing freight, with an aggregate service of 11,390,000,000 ton-kilometers. These figures cover only the inland river and canal transportation, and have no reference to the seagoing commerce of ports like Hamburg, Bremen, and Stettin. As a basis of comparison, it may be stated that Germany had in service in 1900, 49,600 kilometers (about 31,000 miles) of railway, which carried during the year 487,000,000 tons of freight, so that of the whole 559,200,000 tons of inland freight transported in Germany that year 76 per cent was carried by rail and 24 per cent by water.

*The Elbe-Oder-Spree-Havel River and Canal System.*—Berlin is located in the midst of the level, sandy plain of Brandenburg, about midway between the Oder, which flows down on the east from Upper Silesia past Breslau and Frankfort to Stettin, and the Elbe, which is navigable from Hamburg up past Magdeburg to Schandau beyond Dresden. Between these main arteries of river traffic flow the Spree, a short, tortuous, and variable river, which widens at many points into small ponds or lakes, and, after flowing through Berlin, discharges its waters at Spandau into the Havel, a bayou or chain of lakes which has its source in the Province of Mecklenburg, and flows thence southward past Potsdam, where it turns westward, and after many meanderings, during which it frequently widens to a shallow lake or narrows to a deep channel, it flows into the Elbe at Havelburg, about midway between Magdeburg and Hamburg. Throughout this whole region, the consular district of Berlin, the country is so nearly level that the few streams have only sufficient fall to give them a sluggish, uncertain current. The ground is sandy, easily excavated, almost destitute of rock, but so loose and unstable as to require extensive revetments of masonry, timber, etc., to secure the shores of canals and other waterways from abrasion.

It has been the work of nearly two centuries to widen and deepen the Spree, to overcome by artificial means the shallows and other deficiencies of the Havel, to connect them with each other and with the Oder on the east and the Elbe on the west by an elaborate system of canals with locks and sluices for the control of floods, until the Berlin of modern times is the center and mart of a labyrinth of canals and canalized water courses, crowded with boats, which bring the coal and briquettes of Silesia, timber, stone, bricks, lime, fruit,

and other heavy freights from the interior and give the capital direct water transportation to Hamburg and Stettin. It is within bounds to say that but for the combination of natural and artificial water courses for the easy and cheap transport of fuel, building, and other raw materials, the modern city of Berlin, with its 2,000,000 of inhabitants and its vast and varied industries, would have been economically impossible.

As early as 1750 the natural facilities offered by the Spree and Havel became inadequate for the growing requirements of commerce and the process of enlarging and extending them by means of deepened channels and connecting canals began. The latter were at first limited to boats of small capacity and followed usually the tracks of small natural streams that carried off the surface drainage. About 1845 to 1850 the need was recognized of larger boats, wider channels, and more spacious locks and harbors, and from that period the work of improvement assumed a more comprehensive and broader plan. The map of the Brandenburg system of waterways—submitted as an exhibit with this report—shows 11 separate canals, the most important of which, together with the Teltow Canal, now in construction, will be briefly described.

1. *The Landwehr Canal.*—About 7 miles long and built between 1845 and 1850 is a loop or lateral channel which leaves the Spree at the upper or eastern quarter of Berlin, passes round through the southern portion of the city, and debouches into the river below the city in the suburb of Charlottenburg. It is 100 feet in width, with sloping banks faced with solid masonry, receives no sewage, but has a current of clean water averaging 2 miles an hour. The shores are lined throughout most of the distance with trees, and, the space between the sidewalks and top of the wall being turfed and neatly kept, the canal, which is spanned by numerous handsome stone bridges, is not a blemish, but an ornament to the city. Some of the most beautiful vistas of Berlin are along the curving, densely shaded reaches of the Landwehr Canal. It is used by boats 160 to 180 feet in length, which are either poled or towed by tugs, and bring coal, coke, lime, stone, brick, lumber, and other heavy materials to Berlin or seek, in passing from the Elbe to the Oder or conversely, to avoid the more crowded and difficult channel of the Spree where it passes through the city. This canal has two locks, one at its head, the other near its lower junction with the Spree, and has a minimum low water depth of 8 feet.

2. *The Spandauer and Verbindung canals.*—Still more important as a link in the general system is the Spandauer Canal, built about 1848–1851 to connect the Spree at a central point in the city with the Havel in the neighborhood of Spandau. It is about 8 miles in length, and has, besides, several wide basins or pools which serve as harbors for boats and a branch built in 1875 which crosses the suburb of Charlottenburg so as to connect directly with the mouth of the Landwehr Canal above described. Until 1880 the Spandau Canal formed the only practicable outlet westward for boats of large tonnage, but so great had the traffic by this time become that the lower Spree from Berlin to the Havel, parallel to the canal, was canalized and improved as a permanent waterway.

The same necessities compelled at the same time important enlargements and improvements in the upper Spree to the eastward of

Berlin, and the opening of a waterway through to the Oder which would admit the large boats, "Oder Kähne," which are from 180 to 200 feet in length, 28 feet wide, and a capacity of 400 to 660 tons. At that period the upper Spree was connected with the Oder by the old Friedrich Wilhelm Canal at Brieskow, about 50 miles in a direct line eastward from Berlin. From about 1880 this old canal was widened and deepened to meet the new requirements; and

3. *The Oder-Spree Canal*, extended westward, forming a channel, partly canal and partly canalized river—from the Oder to Berlin. The work was completed in 1891 at a cost to the State of 12,700,000 marks ($3,022,600). It opened to Berlin the whole important navigation of the Oder River, which leads down from the remote coal and iron regions of Silesia, past Breslau, Frankfort on the Oder, and Custrin to Stettin, which stands at the head of a long, wide estuary of the Baltic. It gave Berlin not only an all-water downstream route for coal, iron, timber, and building materials from the southeastern frontier of the Empire, but a new and short outlet to the sea, and since the opening of the Kiel ship canal in 1895, much of the British coal used here for gas-making purposes has come to Berlin by the Stettin-Oder-Spree canal route. The opening of this important waterway was followed by such an increase of traffic that within five years a further enlargement was necessary. This was accomplished at a cost of 1,700,000 marks ($404,600) by dredging out the canal at narrow points to a minimum width of 70 feet at the bottom of the channel and securing the banks—which were made steeper by the widening and deepening process—by means of wooden constructions covered with cement slabs. The locks are 200 feet in length by 36 in width, with 9 feet depth of water in the sills—large enough to receive one Oder boat or two of the smaller craft known as "Finow boats," which are 140 feet in length by 16 in width and carry 150 to 200 tons of freight.

Forty miles north of Berlin is the Finow Canal, constructed many years ago and which connects the Oder at Oderburg with the Havel. By this route small boats of the class above described could come from the Oder to Berlin by the long indirect course via the Havel down to Spandau and thence up the Spandau Canal to the capital, but this route has been of only local importance since the opening of the Spree-Oder system in 1891.

During the period from 1888 to 1893 the state government of Prussia, in cooperation with the municipality of Berlin, made extensive enlargements and improvements of the river, the docks, locks, and harbor facilities within the limits of the city. The Landwehr Canal had been improved during the preceding five years at a cost of 3,600,000 marks, and the changes which were made in the Spree and its environment cost 11,000,000 marks, a total expenditure by city and state within ten years of $3,474,800. The Spree was lined with perpendicular walls and the sloping banks cut and dredged out so as to give greater dock area and breadth of channel, which has everywhere at the lowest stage of water a minimum depth of 7 feet. Seventy bridges span the river within city limits, all of which have draw spans or, if immovable, a clear space between roadway and water of at least 14 feet.

4. *The Lower Havel.*—To the westward of Berlin there are, as has been shown, two parallel navigable channels—the lower Spree and the Spandauer Canal—which connect the port of Berlin with the Havel at Spandau. Thence the Havel, which is a meandering bayou that broadens at some places to a width of a mile or more, trends southward past Potsdam and thence again westward and northwestward, until its long, irregular channel finally debouches into the Elbe at Havelburg. This is the direct and highly important water route between Berlin and Hamburg. The distance, following the course of the Haval, from Spandau to its junction with the Elbe is 108 miles, of which perhaps half is through a chain of lakes varying from 200 yards to a mile in width. The original channel was originally so shallow in places that vessels drawing more than 3 feet could not pass at a medium stage of water. The navigation was confined to rafts of timber and wide flatboats of light tonnage which transferred through freight to and from the Elbe boats at Havelburg. In 1875 systematic operations were begun to deepen, widen, and otherwise improve the channel so as to enable Elbe boats to come through to Berlin. The work of dredging the shallow places to a depth of 7 feet and a width of 55 meters (187 feet) was begun in 1875 and finished in 1882 at a cost of 3,000,000 marks ($714,000). This was followed soon afterwards by the construction of the Sakrow-Paretzer Canal, between two lakes which form part of the Haval, by which the navigable route is straightened and a long detour cut off to the southwest of Potsdam. This saved a distance of 9 miles, avoided a group of lakes so wide as to be dangerous to navigation in stormy weather, and opened a comparatively straight water route from Potsdam westward to Brandenburg, where the Havel turns northwestward for its long narrow course to its junction with the Elbe. Through this waterway, which forms an important link in the direct water route between Berlin and Hamburg, boats of various sizes, from 180 to 800 tons burden are towed by steam tugs in strings of 2 to 6. In favorable weather single boats often navigate by sail, but are not towed from the shore. This route brought to Berlin in 1900 more than 2,000,000 tons of freight, including 650,000 tons of bituminous coal from Hamburg, brown coal and briquettes from Saxony, and large quantities of agricultural produce. A glance at the map will show that the lower Havel, while offering a quite direct water route to Hamburg and the lower Elbe, makes a long and troublesome detour for boats plying between Berlin and Magdeburg, Schandau, Dresden, or other points on the upper Elbe. To obviate this difficulty

5. *The Plauer Canal* had been built as early as the middle of the eighteenth century, during the reign of Frederick the Great. It runs from the Havel below Brandenburg directly westward to the Elbe, and is 21.6 miles in length. Its termination in the Elbe proved to have been badly chosen, the current at high water making the handling of boats entering the canal difficult, and to meet this difficulty, as well as to open a valuable district, the Ihls Canal, a branch of the Plauer channel 18 miles in length, was built between 1866 and 1871, which by debouching into the Elbe some 20 miles above the mouth of the Plauer, not only secured a favorable entrance for boats, but saved that distance in upstream navigation. During the early eighties the capacity of the Ihls and Plauer canals was found inade-

quate to accommodate the rapidly growing traffic, and they were enlarged to a bottom width of 125 and a depth of 7 feet, at a cost of 3,250,000 marks. An idea of the development of traffic on the Plauer Canal will be gained from the fact that in 1872, 4,546 boats passed by that route, while in 1900 their number had increased to 12,458, carrying 1,231,000 tons of freight.

It remains to cite the most striking proof of the value which, after years of varied experience, is attached to water transportation for heavy freights. As the through traffic between east and west has developed, there has arisen a demand for a cut-off or side route which would unite the waterways east and west of Berlin while avoiding the delays and expense incident to passage through the locks and crowded waters of the city. For a number of years the project was agitated as a governmental measure, but failed of adoption, and it has now been undertaken as a local enterprise by the district of Teltow, which includes the wealthy suburban cities of Zehlendorf, Lichterfelde, Steglitz, Schoeneberg, and Rixdorf. This district has undertaken and has now in process of construction:

6. *The Teltow Canal*, which was briefly described in a previous report of this series (Advance Sheets No. 1618, April 11, 1903). This important work is 23 miles in length and will run from the Havel at Potsdam in a northeasterly direction, passing through the suburban cities above named and connecting by two mouths with the Spree above the city. It will thus circumvent the crowded channel of the Spree through Berlin and open up a large tract of land to the south and westward of the city for manufacturing and commercial purposes. Its cost is estimated at 25,500,000 marks ($6,069,000), which has been raised by the sale of 3½ per cent bonds guaranteed by the district government, which sell in the market at 98.60. The Teltow Canal will be adapted to boats of all sizes up to 600 tons burthen, and will be the first canal in Germany to be equipped with an up-to-date equipment for electric towage. It was in view of this installation that the competitive experiments in electric towage were made under government supervision on the Finow Canal during the summer of 1902. The work is now about half completed and will be finished within two years. It will not only embody the most advanced ideas of construction and equipment, but will demonstrate the fact that so modern a city as Berlin, fully provided with steam railways and electric transit facilities, is still obliged to extend and improve her water routes in order to maintain her position as an industrial capital.

*Boats in use on the Elbe-Oder system.*—What is known in German administration as the "Elbe-Oder Gebiet" includes the Oder River from Breslau to its mouth, at Stettin, the Elbe from Schandau, on the Bohemian frontier, down to Hamburg, and the whole network of canals and canalized water courses—the Spree and Havel—which connect the Elbe and Oder through Berlin. In the navigation of this system three general classes of boats are used, viz: (1) The "Elbe boats," 228 feet in length, 28 feet wide, and drawing 6 feet with a full cargo of 660 tons; (2) the "Oder boats," 192 to 200 feet in length, 28 feet wide, and carrying 500 tons, with a draft of 6 feet; and, lastly, the "Finow boats," governed in size by the capacity of the old Finow Canal, 145 feet in length, 16 feet beam, and 225 tons

maximum burthen. Besides these classes, which are adapted to both river and canal navigation, there have been built in recent years boats of 800 tons burthen for the navigation of the Oder and up to 1,000 tons, which ply on the Elbe between Hamburg and Magdeburg. These are, however, exceptional. The three standard classes of canal-river boats above described are for the most part towed by steam tugs on the rivers, sometimes drawn by horses or men along certain parts of the canals, and nearly all carry amidships a mast on which a huge square sail is set to catch favoring winds. The mast is stepped in such a manner that it can be lifted out and laid down lengthwise of the boat when a bridge is to be passed or port is reached. Sailing and towage by horses and men are declining as the size of boats increases and speed becomes more important. The day is not far distant when the whole fleet of the Elbe-Oder system will be propelled by electricity and steam.

*Cost of construction and charges upon vessels.*—Until about fifteen years ago canal construction and river improvements throughout Prussia had been undertaken, managed, and paid for by the State. At that time the value of inland water transportation routes had become so fully recognized as indispensable to manufacturing districts and the demand for such improvements was so widespread and urgent that the Government adopted the plan of requiring the communes and districts which demanded them to pay or guarantee the interest of one-third their cost in case the work should upon examination be deemed advisable by the state engineer.

Tolls are collected from boats passing locks throughout the Elbe-Oder system at the following uniform rates:

For boats laden first class, with valuable cargo, 10 cents per 5 tons register; for boats laden second class, with coarse materials, 5 cents per 5 tons register; for boats without cargo, ¼ cent per 5 tons register.

The lock tolls on a cargo of coal or limestone from Stettin via the Oder and the Spree canals to Berlin amount to 3 cents per ton on the actual weight of freight.

*Freight rates.*—The cost of freight transportation on the Elbe-Oder waterways varies and fluctuates according to the stage of water, season of the year, and the demands of commerce. Downstream rates are naturally less than those for the same distance upstream. The following table, furnished by the Shippers' Association of Hamburg, Lübeck, and Stettin, gives the average rates per metric ton on several leading classes of freight from Hamburg upstream to Berlin, Magdeburg, and Dresden, and from Stettin up the Oder to Berlin and Breslau:

[Inclosure C.]

| | Coal. | Stone. | Lumber. | Raw material and fertilizers. |
|---|---|---|---|---|
| Hamburg to— | | | | |
| Berlin | $1.76 | $1.76 | $2.30 | $1.33 |
| Magdeburg | 1.59 | 1.59 | 2.07 | 1.19 |
| Dresden | 2.66 | 2.66 | 3.67 | 1.90 |
| Stettin to— | | | | |
| Berlin | 1.13 | 1.13 | 1.44 | .80 |
| Breslau | 2.19 | 2.19 | 2.64 | 1.58 |

It remains to give some definite idea of the dimensions of the annual canal traffic of Berlin. This is measured by the records of the Wernsdorf and Charlottenburg locks, which are passed, respectively, by boats coming down the Spree and its canals from the Oder and up from the Elbe through the Havel, the Spandau Canal, and the lower Spree. Condensed to their most concrete form the statistics show that in 1900, 32,053 laden boats came to Berlin, bringing 3,771,000 tons of freight, while during the same year 33,327 laden or partly laden boats left Berlin, carrying 1,323,000 tons of merchandise, a total of 65,380 boats and 4,994,000 tons.

FRANK H. MASON, *Consul-General.*

BERLIN, *July 22, 1903.*

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## BRESLAU, GERMANY.

CONSULATE OF THE UNITED STATES,
*July 30, 1903.*

Hon. FRANCIS B. LOOMIS,
*Assistant Secretary of State,*
*Washington, D. C.*

SIR: I have the honor to inclose herewith a report on harbor and river improvements as instructed by department's circular dated May 8, 1903.

I have the honor to be, sir, your obedient servant,

ERNEST A. MAN,
*Consul.*

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### HARBOR AND RIVER IMPROVEMENTS.

The general river and harbor improvements in this consular district are made by the Government, while private corporations and individuals carry out work which is of a local or private character.

There is no apportionment of the cost between the central government and the locality or individuals benefited.

No portion of the expense is paid by tonnage or port dues, and there is no relation between such dues and the expense of improvements made.

Tolls are charged upon canals and canalized rivers and are paid into the general treasury.

The works when executed by the Government are usually carried out by contract under government supervision.

The contract is generally let out by advertising for proposals, these advertisements stating that the Government does not bind itself to accept the lowest bid.

As a general rule when improvements are made in harbors the Government leaves the construction of docks, wharves, etc., to private interests. An exception, however, is to be found at several places along the Oder, notably at Cosel, Breslau, Maltsch, and Glogau, where the docks have been built lately by the Government mainly for coal transportation facilities.

The navigable depth of the Oder along its course is shown in the chart accompanying this. (Inclosure No. 1.)

The rise and fall, as well as the length and depth of the stream, are also shown in the accompanying charts. (Inclosures No. 1 and No. 2.)

The improvements along the Oder River have had a decidedly favorable effect on water freights, and are said to have influenced railroad freights, but not to such an extent as might have been expected were the railroads owned by private corporations.

The following is a table showing the freight rate by water from Breslau to Berlin on the principal articles of freight during the decade 1889–1899:

| Article. | 1889. | 1899. |
|---|---|---|
| Coal | $0.119–0.143 | $0.067–0.102 |
| Heavy freight | .138– .166 | .086– .131 |
| Raw sugar | .166– .179 | .119– .131 |
| Loose cereals | .166– .179 | .109– .131 |
| Light freight | .238– .357 | .143– .238 |
| Wagonloads | .190– .239 | .107– .167 |

Improvements on the Oder are continually going on, and now that the canalization of the river is completed from Cosel to the mouth of the Neisse, a distance of 85.4 kilometers (53.03 miles), at a cost of 13,200,000 marks ($3,141,600), a further canalization is contemplated from the mouth of the Neisse River to Frankfort on the Oder, a distance of 410 kilometers (254.6 miles), and also possibly from Ratibor to Cosel, a distance of 50 kilometers (31.05 miles).

Official statistics show that in the period from 1816 to 1873 a sum of 18,748,000 marks ($4,462,024) was spent for improvements on the lower Oder, or between Breslau and its mouth, while between the years 1874 and 1900 a further sum of 72,603,095 marks ($17,279,536.61) was expended, including the upper stretches of the river, from Breslau to its source.

Of the total amount expended for all purposes, as mentioned above, 23,377,396 marks ($5,563,760.25) was for improvements and construction, while the remainder of the total amount, 49,225,699 marks ($11,715,116.46), was spent for operating and keeping in repair.

The present annual cost of such work during the past five years was as follows:

| Year. | Marks. | Equivalent in United States currency. |
|---|---|---|
| 1898 | 2,047,771 | $487,370 |
| 1899 | 2,188,605 | 520,888 |
| 1900 | 2,079,152 | 494,838 |
| 1901 | 2,233,292 | 531,571 |
| 1902 | 2,741,043 | 652,368 |

Official statistics of the tonnage handled are obtainable, but values are not given.

The total tonnage carried both up and down the canalized river and canals connected with it for the year 1900 was 12,056,072 metric tons.

ERNEST A. MAN, *Consul.*

BRESLAU, GERMANY, *July 29, 1903.*

(NOTE.—The illustrations referred to in the above report have not been reproduced as a part of this document.)

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### COBURG, GERMANY.

CONSULATE-GENERAL OF THE UNITED STATES,
*June 5, 1903.*

Hon. FRANCIS B. LOOMIS,
*Assistant Secretary of State, Washington, D. C.*

SIR: Answering department circular of May 8 in re "Harbor and river improvements," I beg to say that the district of this consulate-general is an inland district, with no harbors; it extends over the range of the Thuringian Mountains, where numerous brooks and rivulets originate. None of them being navigable and there being no locks nor canals, none of the questions put in department's circular are applicable to my district.

I have the honor to be, sir, yours, most respectfully,

OLIVER J. D. HUGHES,
*United States Consul-General.*

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### CREFELD, GERMANY.

CONSULATE OF THE UNITED STATES,
*July 25, 1903.*

Hon. FRANCIS B. LOOMIS,
*Assistant Secretary of State, Washington, D. C.*

SIR: I have the honor to report, in answer to the request from the department for information in regard to harbor and river improvements, there are no harbors in the Crefeld district.

In the year 1901 the city of Crefeld authorized a loan of 11,000,000 marks for the purpose of constructing a harbor on the river Rhine and a railway to connect the city proper with the harbor. I had been led to believe these improvements would not be undertaken for some time, and, in fact, as improbable, but upon seeing the work actually commenced, I secured such information as could be obtained, from which I am led to believe the proposed enterprise will be of great importance to this locality by encouraging the development of manufacturing industries and in trade and commerce.

I communicated the fact of the commencement of the work on the harbor to Hon. Theodore E. Burton and invited him to come and inspect it. I have just received an answer from him saying that if possible he will visit the district in September, and that Major Mahan is anxious to spend some time here.

Although there is no statistical information to be obtained from this district upon the general subject of the inquiry, as outlined in the department circular, I have deemed it of possible interest or importance for the department to have a description of the proposed improvements contemplated by the city, with a plan of the harbor now being made; therefore, have embodied the same in a short report and send same herewith, accompanied with duplicate and one set of maps, showing location, plan, and proposed route.

The maps are difficult to be obtained.

I am, sir, your obedient servant,

THOMAS R. WALLACE,
*United States Consul.*

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The people of the city of Crefeld have been confronted with the fact that for many years the enumeration of the population has ceased to show an increase in numbers. Thousands leave permanently each year, while hundreds of its people are compelled to go and return daily, to outside points, for employment.

The local pride and patriotism of the people have been aroused to devise some plan to remedy this condition and to provide employment for its increased population by encouraging the installation of varied industries within its jurisdiction.

The greatest objection met with in attempting to induce investments in new industrial enterprises is the cost of transportation, especially that of coal and other heavy material, and the city finds it is at great disadvantage compared with other points having waterway communication with the source of supply of such material and for shipments of manufactured articles.

The city authorities have undertaken to overcome this disadvantage by making a harbor on the river Rhine and connecting it with the city proper by railway, a distance of 3¾ miles. The city limits extend to the river and the municipality owns the realty upon which the harbor will be made; therefore it is in a position to grant concessions as an inducement to build manufactories upon sites fronting upon the harbor.

There are many advantages presented by the location of the harbor at this point. When completed, it will be the only harbor having proper accommodations for all classes of river steamers on the left bank of the river from Cologne to and beyond the German frontier. But few places on the left bank are suitable for harbor purposes; all of the available points on the right bank are occupied. In addition, the location is in the midst of a rich agricultural region, interspersed with numerous manufacturing villages and towns, densely populated, and railway connections with all important points on the continent.

It is also looked forward to with confidence that eventually a ship canal will be constructed from this point by the governments of Germany, Holland, and Belgium to connect with the sea at Antwerp, thus shortening the waterway from the river at this point to the sea nearly one-half. It will pass through a rich and fertile country and connect with important trade and manufacturing centers and with a number of waterways now used for commercial purposes.

The canal has been in contemplation for some time. No serious physical difficulties appear to prevent its construction; the country is

practically level, although the descent to the sea thus shortened will necessitate the construction of several locks to obviate the increased flow of the current of the stream.

Surveys and estimates of the proposed canal have been made, which show that the work can be readily done at minimum cost, and it would be but a small burden upon each of the governments to construct its respective share of the enterprise.

In fact, the line of the proposed canal from Crefeld makes connection with a small canal, constructed for light traffic, which has been in operation for many years, and commences about 14 miles from the German frontier, thence to Antwerp.

The obstacle in the way is the fear of the Hollanders that the proposed canal would divert a large portion of the carrying trade from Rotterdam and Amsterdam and seriously injure the shipping interests and commercial business of those cities. They believe the advantages gained would not compensate them for the expense incurred and loss sustained.

The city of Crefeld has authorized a loan of $2.618,000 to be expended in constructing the harbor and railway, to build docks, wharves, and terminals for freight, and to purchase the realty upon which same is located, with the land surrounding the harbor, to be used as sites for both manufactories and residences.

This sum is to be procured by loans as needed: interest is limited to 4 per cent; it is expected to place these loans at 3½ per cent, or less; a tax has been levied to meet the interest when due and to provide a sinking fund of 1½ per cent of the authorized loan annually.

The work of construction will be let by contract to the lowest responsible bidder.

The waterway for the harbor will be made entirely by excavations; the earth is of loose formation, no hard cuts, and the dirt can be removed at a cost of 55 pfennigs, about 13 cents, per cubic meter.

It is planned to make an outer harbor about 1,600 meters in length, extending up the river nearly parallel with it; a branch commences near the center and connects with the inner harbor about 600 meters distant, and again branches, one part extending west 1,300 meters and the other southwest 2.5 kilometers.

A contract has been made to construct the outer harbor, and work has just commenced upon it: it will be 100 meters wide from the entrance to a distance of 460 meters, at which point a drawbridge will span it, with wings of sufficient width to permit the passage of the largest steamers and their barges in tow: a space will be inclosed on the south side, 40 meters broad, by driving piling parallel with the shore from the entrance to the drawbridge, to be used for the storage of log rafts and lumber business; and the building sites on all this part facing the boom will be kept exclusively for lumber industries. This part of the harbor is called "Rhein Harbor."

Above the drawbridge the harbor rapidly widens, giving sufficient circumference for the largest river steamers to turn, and is called the first turning place: from this turning place to the end the harbor is 65 meters wide and 900 meters long, and is called "East Harbor;" at the end is another turning place for steamers, also a mill brook enters the harbor at this place to provide fresh water.

Along the shore of the river opposite the harbor landing places, wharves, and docks, will be constructed, with ample railway accom-

modation, provided with suitable conveniences for transferring freight. The land facing the harbor upon all sides will be used as sites for all kinds of manufacturing industries, and will be ready to commence the erection of buildings in 1904.

It will cost to purchase the realty and complete this part of the proposed enterprise $1,904,000, and the work will be finished in 1906.

The favorable position of the harbor entrance assures security against trouble from sand bars; the bottom is to be lower than the bed of the river. It is expected to charge 4.71 cents per ton wharfage dues and 7.14 cents tonnage.

The authorities are still undecided whether to construct a steam or electric railway; work on the roadbed will commence in 1904, and it is intended to have the railway ready for business in 1906; the cost is estimated at $238,000.

THOMAS R. WALLACE,
*United States Consul.*

CREFELD, GERMANY, *July 24, 1903.*

(NOTE.—The illustrations referred to in the above report have not been reproduced as a part of this document.)

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## DRESDEN, GERMANY.

### HARBOR AND RIVER IMPROVEMENTS.

CONSUL-GENERAL OF THE UNITED STATES,
*June 19, 1903.*

In response to the various inquiries contained in the circular issued by the Department of State on May 8, 1903, I have the honor to report as follows:

The only navigable stream in this consular district is the river Elbe, which is navigable for large-sized steamers from Hamburg to Leitmeriz, in Bohemia, and for smaller vessels still farther. The river Elbe is mainly navigated by boats using the chain system described in my report to the Department of State, dated May 20, 1902.

*Question 1.*—The cost of river and harbor improvements are carried by the Saxon Government. Each year a certain sum is appropriated for such improvements, and in 1902–3 an appropriation of 510,000 marks ($125,000) was made for improving and maintaining the river Elbe within the Dresden district. Special improvements are made from time to time and receive special appropriations; for instance, the King Albert port was recently built at Dresden at a cost of 7,500,000 marks ($1,750,000).

(*b*) None.

(*c*) None.

(*d*) No tolls or port dues as such are charged for through traffic, but a charge is made for loading and unloading and for protection and dockage of vessels during the winter season. These charges vary to such a wide range that it is impossible in a report of this kind to give them in full, but I inclose two booklets of tariffs, rules, and regulations regarding the freight traffic on the river Elbe within the Dresden district, marked "Exhibits A and B."

A charge of 1 to 150 marks, according to the tonnage of the vessel, is made for dockage in port during part or all of the winter, for which ample and safe quarters are provided by the Government at considerable expense.

(*e*) The improvements are made by the Government at its own expense.

(*f*) No tolls are charged.

(*g*) The work is almost invariably done by contract.

(*h*) By advertising for bids, same as done by the Government at Washington, and contractors are required to furnish bond for the faithful performance of their contract.

*Question 2.*—All the local improvements, such as docks, wharves, freight terminals, etc., are made by the Government, with the exception of wharehouses, sheds, etc., erected by private parties on leased space.

*Question 3.*—Mean water depth of river Elbe is 1.40 meters (4 feet 7 inches); lowest navigable depth of river from Tetschen, Bohemia, to Hamburg, is 93 centimeters (3 feet ⅓ inch), with corresponding draft of vessel of 83 centimeters (2 feet 8½ inches). No tide.

*Question 4.*—The channel depth and width at mean low water vary greatly, and I have no means of ascertaining these facts outside of this consular district.

*Question 5.*—I can not state the increase, respectively, in recent years of freight carried by railways and inland waterways, but at present the railways carry 70 per cent and the waterways 30 per cent of the tonnage.

*Question 6a.*—Rates for the carriage of freight by waterways vary almost daily, according to depth of water, dispatch in loading and unloading, season of the year, price of coal, etc. At the approach of winter and in winter during the time the Elbe is navigable rates are considerably higher than in spring and summer.

*Question 6b.*—The traffic on the improved waterways has no particular influence upon the freight charges of the railroads. The latter, being controlled and owned by the Government, maintain, with occasional variations, a tariff of rather high rates, and I have ascertained that the railroads do not compete in rates upon property destined to be reached by the river.

*Question 7.*—The tendency is to continue the development of inland waterways.

*Question 8.*—Information can not be ascertained.

*Question 9.*—The statistical reports issued by the Handelskammer regarding the tonnage handled and the value thereof have been discontinued in 1890, but there are statistics scattered through various official yearly records. The total tonnage handled in the port of Dresden in 1902 was 383,732 tons. Value not stated.

*Question 10.*—There are no canals, locks, or dams in the Dresden district.

*Question 11.*—The engineering work carried on in improving the river consists in erecting and maintaining quays, wing dams for the deepening of the river bed, continuous dredging, etc.

I realize the meager information contained in this report, but it should be considered that the Dresden Chamber of Commerce are forbidden to give out information to foreign consuls and that all government and private bureaus are loth to answer inquiries, making it almost impossible to collect statistics for a report of this character.

CHAS. L. COLE, *Consul-General.*

NOTE.—The illustrations referred to in the above report have not been reproduced as a part of this document.

## FREIBURG, GERMANY.

### CANALS OF ALSACE-LORRAINE.

CONSULATE OF THE UNITED STATES,
*September 14, 1903.*

Alsace-Lorraine has a great network of canals, of which the most important are: (1) The Rhine-Marne, extending from Marne River, in France, past the city of Nancy, France, to Strassburg, Alsace; (2) the Saar canal system, from the River Saar, at Sarrgemuend, in the northern part of Lorraine, southward, joining with the Rhine-Marne Canal; and (3) the Rhine-Rhone system, connecting the Rhine with the Rhone in France, and extending in Alsace from Strassburg to Mulhausen, thence westward toward Belfort, France.

One of the chief articles transported on these canals is coal, brought from Belgium and from the Saar and Ruhr districts of Germany. In the winter season the formation of ice interferes somewhat with this traffic, the closed season averaging from fifty to sixty days. Other articles transported in great quantities are limestone, sandstone, lime, chalk, sand, and porcelain earth, grain, fertilizers, petroleum, naphthalene, chemicals, iron ores, grindstones, etc.

The total traffic on these canals and the Mosel River during 1900 and 1901, and the classification, is shown in the following table:

| Classification. | 1900. | | 1901. | | Decrease in 1901. |
|---|---|---|---|---|---|
| | *Tons.* | *Per cent.* | *Tons.* | *Per cent.* | *Tons.* |
| Importation | 561,365 | 31.7 | 496,640 | 29.9 | 64,725 |
| Transportation | 422,291 | 23.9 | 398,650 | 24 | 23,641 |
| Inner traffic | 561,929 | 31.8 | 552,356 | 33.2 | 9,573 |
| Exportation | 222,860 | 12.6 | 214,382 | 12.9 | 8,478 |
| Total | 1,768,445 | 100 | 1,662,028 | 100 | 106,417 |

The general average distance of all the commodities transported on the Alsace-Lorraine system of canals during 1901 was 66.37 miles; during 1900, 65.47 miles.

E. THEOPHILUS LIEFELD,
*Consul.*

FREIBURG, GERMANY, *September 14, 1903.*

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## HANOVER, GERMANY.

CONSULATE OF THE UNITED STATES,
*May 21, 1904.*

The ASSISTANT SECRETARY OF STATE,
*Washington, D. C.*

SIR: I have the honor to inclose answers to some of the questions contained in the department's instructions, "Harbor and river improvements," May 6, 1903.

I am, sir, your obedient servant,

JAY WHITE,
*United States Consul.*

HARBOR AND RIVER IMPROVEMENT.

1*a*. The improvement of navigable rivers and the construction, maintenance, and improvement of harbors are carried out by the States interested. The empire only takes care of naval stations. Private corporations or individuals are permitted to undertake such work solely for their own use and under the supervision of the several States.

1*b*. The costs for the construction, maintenance, and improvement of harbors are defrayed by the States concerned, the Empire giving a proportional contribution if any conditions of national importance are fulfilled. This, however, is seldom the case. If the construction of a harbor is of especial interest to an individual city, that city pays a proportionate amount toward the costs. The few cities that are the actual possessors of a harbor are liable for all the costs; though the State may, if it see fit, make a contribution.

1*c*. These proportionate contributions rarely occur, and up to the present time there has been no fixed scale according to which they have been arranged. Each case is decided separately, and in the negotiation the community concerned is quite independent of the State.

1*d*. The quays and storage room, etc., belonging to the harbor are for the most part let in lots to individuals or corporations. There are a few public quays, and the charge for their use is in accordance with the tonnage of the vessel and the time taken. It is to these fees that the state authorities look for a return for the money expended, but to prevent trade being seriously affected the amount of the fees is in many cases merely nominal.

1*e*. All improvements in such state property are paid for by the State concerned, though suggested by communities, corporations, or individuals. More or less pressure, however, according to the fiscal policy of the existing minister, is brought to bear upon the authors of the suggestion, in order to induce them to make a contribution in a lump sum toward the cost. In the few instances in which property of this kind belongs to local communities or individuals, any improvements are paid for by such communities and individuals.

1*f*. A regular fee is charged for the use of canals and canalized rivers, but none for rivers that have been made navigable or improved. Such fees are collected by local authorities and transmitted to the state or city funds. All the more important improvements have to be sanctioned by the parliamentary committee of works.

1*g*. Works executed by the individual States are carried out by contract, which is considered the more economical method.

1*h*. The contractors have to furnish a large bond and pay a high penalty if the work is not completed in the specified period. During the execution of the contract the work is subject to inspection. The contractors have no appeal to the ordinary law courts, but disputes are settled by a special board of official engineers.

2. States and communities that build the harbors also, as a rule, build the necessary docks, quays, stores, and machinery required for them. Some large corporations or firms that have hired space construct their own works.

3. The approaches from the sea to the greater towns on the seaboard have a minimum depth of 19.68 feet to 29.52 feet. The outer harbors have a minimum depth of 36.08 feet. At the points where

ships are laden the minimum is increased from 3.28 feet to 9.78 feet, according to the local circumstances of tide.

| | Length navigable. | Mean depth. | Mean width. |
|---|---|---|---|
| | *Miles.* | *Feet.* | *Feet.* |
| Rhine | 447.38 | 9.84 | 1,968.00 |
| Weser | 279.61 | 2.62 | 590.55 |
| Elbe | 509.52 | 3.28 | 1,279.52 |
| Oder | 385.24 | 2.95 | 656.16 |
| Weichsel | 155.34 | 8.20 | 3,280.33 |

The Rhine, Elbe, and Weichsel are navigable before entering Germany, the Weichsel to the extent of 434.95 miles.

Compared with the mileage of the rivers the canals are unimportant, their total length not reaching 248.54 miles. Their depths correspond with the minimum depth of the rivers. As an argument in favor of the further construction of inland waterways in Germany it is claimed that in England and America the item of freight is only from 7 to 10 per cent, while in Germany it is from 28 to 30 per cent.

It is also stated that the railways will not be able in the future to accommodate the increased traffic.

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## MAINZ, GERMANY.

### HARBOR AND RIVER IMPROVEMENTS IN THE GRAND DUCHY OF HESSE.

CONSULATE OF THE UNITED STATES,
*September 16, 1903.*

The improvements, maintenance, and repairs of navigable rivers in the Grand Duchy of Hesse are carried out by the central Government, and the cost is borne by same. The construction, improvement, and maintenance of harbors is, however, as a rule, carried out by and at the expense of the various municipalities. For the construction of the harbors of Mainz, Worms, Bingen, and Offenbach the central Government voted a contribution which amounted to about what the Government would probably have had to spend for improving the river banks in the course of time. At the towns of Oppenheim, Gernsheim, and Neckar-Steinach the Government constructed shelter harbors, to the costs of which the respective municipalities contributed about one-third of the amount, in round figures.

In the harbors port dues are collected by the municipalities. There exists a certain relation between such dues and the expense of maintaining and improving the harbors, inasmuch as the port dues must be reduced if the receipts exceed the cost of maintaining the harbor works and management, plus the interest on the capital invested by the municipalities.

In several cases large private corporations have built their own harbors in connection with their plants, as, for instance, the cement works and chemical works at Amoeneburg.

Tolls are not charged upon traffic on the canalized rivers of the Grand Duchy. There is, however, only one small stretch of such rivers, namely, between Frankfort and Offenbach.

Only dredging and smaller repairs are executed by the Government with hired labor; all the more important works are carried out by contract. It is not always that a contract is let to the lowest bidder, but as a rule it is let to that one of the three lowest bidders who is best able to carry out the work.

The depth, at mean low water, of the leading harbors is 0.3 meter greater than the average depth of the adjoining rivers.

The rivers Rhine, Main, and Neckar, so far as they run through the Grand Duchy of Hesse, are navigable.

The length of the river banks belonging to the Grand Duchy of Hesse, of the three above-mentioned rivers, is as follows:

| | Kilometers. |
|---|---|
| River Rhine: | |
| Left bank | 90.9 |
| Right bank | 64.7 |
| River Main: | |
| Left bank | 59.5 |
| Right bank | 2.9 |
| River Neckar: | |
| Left bank | 11.8 |
| Right bank | 16.4 |

The normal depth of the Rhine is 2 meters below mean low water; that of the canalized Main, 2.5 meters; that of the regulated Main, 1 meter, and that of the Neckar, 0.6 of a meter.

The government of the Grand Duchy of Hesse has expended during the period from April 1, 1888, to March 31, 1901, for the improvement, construction, maintenance, and repair of rivers, harbors, and canals as follows:

| | Improvements and construction. | Maintenance and repairs. | Total. |
|---|---|---|---|
| | *Marks.* | *Marks.* | *Marks.* |
| For the Rhine | 4,742,079 | 1,981,907 | 6,723,986 |
| For the Main | 1,783,325 | 264,398 | 2,047,723 |
| For the Neckar | 165,886 | 116,183 | 282,069 |
| | 6,691,290 | 2,362,488 | 9,053,778 |

For further detailed information regarding the traffic on the Rhine, the water levels at various periods of the year, freight rates, etc., I beg to refer to the "Jahresbericht der Centralcommission fuer die Rheinschifffahrt" (Annual report of the central commission for shipping on the Rhine), published by the "Akademische Buchdruckerei," Munich, a copy of which I herewith beg to transmit.

WALTER SCHUMANN, *Consul.*

MAINZ, *September 16, 1903.*

NOTE.—The document referred to in the above report has not been reproduced as a part of this document.

## MANNHEIM, GERMANY.

CONSULATE OF THE UNITED STATES,
*July 18, 1903.*

Hon. FRANCIS B. LOOMIS,
*Assistant Secretary of State, Washington, D. C.*

SIR: I have the honor to inclose herewith a report on the rivers and harbors of this consular district, pursuant to instructions in department's circular of May 8.

In view of Mannheim's location at the head of the heavier Rhine shipping, and the fact that it leads all the interior Rhine cities in the extent and value of its shipping interests, I have thought it might not be improper for me to present as a part of my report a somewhat general survey of the Rhine and its shipping interests.

This I have first done. Then follows a review of the several harbors of this district, and finally a general summary in which the questions of the circular have been answered in order as far as I am able to do.

Accompanying the report is a little index that will aid in referring to any topic presented.

On July 11 Hon. T. E. Burton and a party of three gentlemen came to this city for the purpose of inspecting the harbors. From previous correspondence with Mr. Burton I knew of his coming and had arranged for the inspection. The state harbor management of Mannheim had placed a small steamer at my disposal, as also engineers from the state railway control, the city harbor board, and the state harbor management. Abundant charts and maps were also supplied. On their own motion the authorities had sent to my office for an American flag to fly from the boat. The inspection was made under somewhat favorable conditions and seemed to be satisfactory to Mr. Burton and his party.

I was asked by Mr. Burton to send to him at Berlin a copy of this report, which I have already done.

As an aid in referring to the harbors in this district I have secured several plans, which are forwarded to the department under other cover as a part of this report.

I have the honor to be, sir, your obedient servant,

H. W. HARRIS,
*United States Consul.*

The Mannheim consular district is traversed from south to north by the Rhine River, about 60 miles of the river being in this district. For the larger part of this course the Rhine forms the boundary between the two States of Baden and Bavaria; through the remainder of the distance it is in the State of Hesse, the principal river town of which is Worms.

At Mannheim the Rhine receives the Neckar from the east. The harbors of the district, therefore, include those of the two rivers, both of which are navigable, the Neckar being relatively of small importance.

The Rhine harbors at Mannheim, Ludwigshafen, Carlsruhe, and Worms are important and will be treated separately. The harbors of the Neckar at Mannheim are also important and will be referred to in connection with those of the Rhine at this city.

## GENERAL SURVEY OF THE RHINE.

As is well known, the Rhine is the most important river of Germany and has a commerce of great extent. This commerce has grown rapidly the past twenty-five years and shows a decided tendency toward further growth.

Closely connected with this development, and certainly in large part the direct cause of it, have been the harbor and other improvements which have taken place along the entire course of the river, notably during the past forty years.

The Rhine has a marked natural advantage over many of the navigable rivers of Europe in the slight interruption to navigation due to low water, floods, or ice. Fed as the river is during the hot summer months by melting snows in the Alps, it is less subject to low-water stages than rivers of its class usually are. Lake Constance, of which the Rhine forms the outlet, tends to further equalize the depth of the river throughout the year.

Thus the average period during the year in which shipping is interfered with from the causes named has been found to be about forty-two days, divided as follows:

| | Days. |
|---|---|
| High water (overflowing harbors at Diusburg and Ruhrort and interfering with coal trade) | 8 |
| Ice | 17 |
| Low water | 17 |

However, with these and other natural conditions much has been left to human enterprise and industry to perfect the waterway and render it accessible to commerce.

A map of the Rhine of fifty years ago shows a succession of bends and sinuous windings and of low swampy shores that have largely disappeared as the channel has been straightened and low lands filled in and protected by long stretches of stone walls. Dredging, blasting, and other work have cleared the channel of much sand and rock and otherwise facilitated navigation. While at nearly every Rhine town commodious harbors, basins, warehouses, and improved appliances for loading and unloading freight have been constructed. In a very considerable degree the authorities of the several States adjacent to the river have undertaken and carried out the improvements made, recognizing, as it would seem, their importance as bearing upon state revenues and upon the general welfare. In many instances the need of such improvements has been first pointed out by chambers of commerce and other bodies. The municipal corporations directly affected have in many cases joined with the State in making the improvements.

From Mannheim to Rotterdam by river is 355 miles. Throughout this entire distance, 272 miles of which is in German territory, the work of river improvement has been carried out as it has up the Main, the Neckar, and other tributaries of the Rhine, and certainly with gratifying results.

Shipping and manufacturing interests along the river and its tributaries have in the meantime increased enormously. Not only has it given to numerous Rhine cities a new and vastly increased commercial importance, but it has had a direct influence upon a region comprising the whole of southwest Germany, with parts of Switzer-

land and Italy, and indeed upon the entire Empire. As in the earlier centuries the commerce of the East found entrance to middle Europe by way of the Adriatic Sea and gave to Venice and the Italian republics their unique commercial importance, so the tendency to-day is to utilize in a high degree the Rhine and other rivers of Germany as great highways practically to the center of Europe for the vastly greater commerce with the West.

With but a single transfer from ocean vessel to river barge at Rotterdam, Antwerp, and other seaports vast quantities of grain, lumber, petroleum, and other freight are brought by water at a low freight rate to points from 300 to 400 miles or even more into Germany and from river ports distributed by rail over a large area.

In the year 1902 the amount of merchandise that crossed the border between Holland and Germany by Rhine boats up stream and down reached a total of 14,286,486 metric tons (metric ton equals 2,204 pounds). This amount is not to be confounded with the total Rhine freight tonnage, which includes coal and other domestic trade far surpassing these figures.

(As of possible interest, attached hereto will be found newspaper clippings showing the boats crossing the German-Holland border upstream on recent single days selected at random. Name of boat, cargo, destination, etc., are given. It will be noted the days are in the month of June, 1903.)

Omitting timber rafts and some small seagoing boats, the merchandise that crossed the border between the two countries by Rhine boat during the year named was as follows:

| | Tons. |
|---|---|
| Freight upstream | 8,196,099 |
| Freight downstream | 5,774,414 |

Of this upstream freight there came from—

| | Tons. |
|---|---|
| Rotterdam | 6,453,423 |
| Belgian ports | 1,390,412 |
| Amsterdam | 251,969 |
| From other ports | 100,295 |

As the Empire has in recent years grown in manufacturing and commercial importance, it would be natural to expect rapid increase in railway and in river shipping. In the latter the increase has been especially marked in the Rhine cities.

Thus the growth of this shipping in foreign and domestic commerce at some of the principal river ports for the period from 1875 to 1901 will appear from the following figures, taken from recently published statistics:

| Year. | 1875. | 1885. | 1895. | 1900. | 1901. |
|---|---|---|---|---|---|
| Mannheim | 537,000 | 1,716,000 | 3,280,000 | 5,328,000 | 5,145,000 |
| Ludwigshafen | 128,000 | 518,000 | 769,000 | 1,777,000 | 1,763,000 |
| Worms | 52,000 | 104,000 | 200,000 | 275,000 | 288,000 |
| Gustavsburg | 120,000 | 426,000 | 576,000 | 1,024,000 | 1,139,000 |
| Mainz | 130,000 | 205,000 | 209,000 | 287,000 | 571,000 |
| Cologne | 189,000 | 318,000 | 625,000 | 874,000 | 743,000 |
| Dusseldorf | 139,000 | 183,000 | 336,000 | 620,000 | 583,000 |
| Duisburg | 937,000 | 1,417,000 | 2,282,000 | 4,746,000 | 4,725,000 |
| Ruhrort | 1,677,000 | 2,441,000 | 4,507,000 | 6,701,000 | 6,758,000 |

The two last-named ports are important mainly for large shipments of coal mined in the adjacent coal districts.

Further evidence of this growth is to be found in the number and tonnage capacity of the boats employed on the Rhine in recent years. The following figures are for iron boats and barges and cover the period from 1882 to 1901:

| Tonnage capacity. | 1882. | 1890. | 1900. | 1901. |
|---|---|---|---|---|
| Under 250 tons capacity | 110 | 269 | 1,131 | 1,230 |
| From 250 to 500 tons | 262 | 470 | 1,106 | 1,221 |
| From 500 to 1,000 tons | 162 | 546 | 1,063 | 1,011 |
| From 1,000 to 1,500 tons | 2 | 73 | 383 | 418 |
| From 1,500 to 2,000 tons | ..... | ..... | 142 | 172 |
| From 2,000 to 2,500 tons | ..... | ..... | 4 | 14 |
| Total | 542 | 1,359 | 3,735 | 4,057 |

Showing that while the total number of iron boats and barges that formed the Rhine fleet in 1882 was but 542, in 1901 the number of such boats had increased to 4,057.

The total tonnage capacity of this class of boats in 1882 was 227,063 tons, while but nineteen years later it had increased to 2,133,411 tons.

Although an increase of wooden boats and barges during the corresponding period is to be noted, the increase is comparatively slight, as will appear from the following table:

| Tonnage capacity. | 1882. | 1890. | 1900. | 1901. |
|---|---|---|---|---|
| Under 250 tons | 2,609 | 3,964 | 3,718 | 3,720 |
| From 250 to 500 tons | 373 | 482 | 573 | 588 |
| From 500 to 850 tons | 36 | 27 | 15 | 14 |
| Total | 3,018 | 4,483 | 4,306 | 4,322 |

The increase of tonnage capacity in this class of boats for the period named was 120,489 tons, the total tonnage capacity in 1901 being 588,796, as against 468,307 in 1882.

### RHINE PASSENGER TRAFFIC.

To the freight carried on the Rhine is to be added a passenger traffic of no small importance. Many of the passenger steamers are large and handsomely equipped. Two of the newest are 272 feet long and have 1,250 indicated horsepower. The Coln-Dusseldorfer Dampfschiffahrts-Gesellschaft, to whose large fleet these two boats belong, claim to have carried upward of 1,500,000 passengers in 1901. Other similar companies have an important passenger traffic.

### COMPARATIVE GROWTH OF RAILWAY AND OF RIVER SHIPPING.

A comparison of railway and of water shipping statistics in all parts of Germany where both branches exist would certainly show that both have increased rapidly in recent years. This has been eminently true in the Rhine district. By reason of the interdependence of the two branches at Mannheim, for example, the rate of increase and the aggregates carried by rail and by water do not differ

greatly, though the tonnage of freight by water has made a substantial gain over that by rail. For the forty years from 1860 to 1900 the figures are as follows:

| For the year— | Railway tonnage (in metric tons). | Water tonnage (in metric tons). |
|---|---|---|
| 1860 | 220,000 | 240,000 |
| 1870 | 340,000 | 410,000 |
| 1880 | 880,000 | 960,000 |
| 1890 | 2,050,000 | 2,680,000 |
| 1900 | 3,900,000 | 5,330,000 |

## INFLUENCE OF WATERWAYS ON RAILWAY FREIGHT RATES.

It would certainly be impossible to state in figures the exact influence improved waterways have had on railway freight rates in Germany. Undoubtedly their influence has been to lower these rates, but other influences have tended in the same direction, and have been effective in localities where water traffic has not come into competition. The enormous increase in manufacturing in Germany the past few years, the growth of cities, and the strides made in all departments of commerce and industry have called for the extension of railway lines and lower freight rates.

The disposition on the part of the several States and of the Empire has been certainly to encourage manufacturing and commercial enterprise. The several States, as owners of the principal railways, have frequently been able to do this on somewhat broad lines by the improving of shipping facilities.

The subject of freight rates, especially on raw materials, is one constantly referred to in manufacturing and other papers in Germany as having an important bearing on the country's industrial position in the foreign market. In a recent review of the subject it is pointed out that in the use of cars of large capacity for handling coal and coke the railways of the United States have secured an advantage hauling this kind of freight that can be met on this side only by the adoption of similar rolling stock.

The further improvement of the navigable rivers of Germany, the construction of additional canals, and even the taking into state control of river shipping, as has been done in the case of the railways, are all referred to as incidental factors in securing further reductions in the cost of transporting freight.

As perhaps an extreme example of the differences between water and railway rates in the Rhine district may be cited the freight rate on wheat from Rotterdam to Mannheim. The distance is 355 miles. The water rate varies from $2\frac{1}{2}$ to $3\frac{1}{2}$ marks ($0.70 to $0.83) per ton in barge loads, depending somewhat on the season and the stage of the water. The present railway rate on the same products in carload lots of 10 tons each is 184 marks (or at the rate of $4.38 per ton).

For the purpose of further comparison may be cited the railway rate from Mannheim to Strassburg, a distance of 82 miles, the present rate on wheat per car of 10 tons being 71 marks, or at the rate of about $1.69 per ton.

In an article recently published in the Niederrhein on the subject of railway and water freight rates in Prussia the author points out among other things that the railway rate for coal over the Prussian lines is from 1.18 to 1.65 pfennigs (1 pfennig is approximately one-fourth cent) per ton per kilometer of distance (one kilometer equals 3,280 feet or approximately two-thirds of a mile). The illustration cited by the author would indicate about 1.30 pfennigs to be the average rate.

The water rates on three of the most important rivers of the Empire, all of which flow through the Prussian territory, are also cited as follows:

| | Lowest rate per ton per kilometer. | Highest rate per ton per kilometer. | Average rate per ton. |
|---|---|---|---|
| | *Pfennig.* | *Pfennigs.* | *Pfennig.* |
| On the Oder | 0.404 | 0.93 | 0.667 |
| On the Elbe | .46 | .92 | .69 |
| On the Rhine (for coal) | .31 | .75 | .53 |
| On the Rhine (for ore) | .2 | 1.08 | .64 |

The author states in the course of his review that the average freight rate in the United States for transporting coal and ore is about 0.64 pfennig per ton per kilometer, and that in certain cases the rate has been as low as 0.40 pfennig.

Recently published rates for German canal transportation show that this rate has gone even below the river rate. The tendency throughout the Empire is certainly toward further improvement of waterways. The subject is regarded as of prime importance, and will continue to claim the attention of state and municipal authorities. Several canal enterprises are at present under consideration. Part of them will doubtless be carried out.

As a rule the states have taken the initiative in the matter of canal construction and ownership. Thus, of the 1,810 kilometers (1,125 miles) of canals and canalized rivers all except 180 kilometers (112 miles) belong to the state.

On the other hand, in the construction of ordinary river improvements, municipalities or private concerns, usually the former, have taken up the project and borne the larger part of the expense. For example, in 1901 the several German Rhine States expended for river improvements on the Rhine 2,356,650 marks ($560,882), while in the same year the amount expended by municipalities and by private parties was 13,022,814 marks ($3,099,430).

## RHINE TRIBUTARIES.

The extent to which commerce has followed up the tributaries of the Rhine is scarcely less remarkable than the growth of commerce on the Rhine itself. These tributaries are all comparatively small streams, but a few rods wide, and yet several of them have a considerable commerce. Of these tributaries, the Neckar, the Main, the Lahn, and the Ruhr, from the east, and the Ill and Mosel, from the west, are all navigable, and each is used for shipping purposes. Through

the Regnitz and Ludwigs Canal, the Main is connected with the Danube system, and has a large traffic. That at Frankfort-on-the-Main amounts to many thousand tons each year. The Mosel is navigable for about 180 miles, extending to the French border.

### PROJECTED IMPROVEMENTS.

Among the projects for the further improvement of the Rhine in this locality is that of changing the channel, or constructing a canal so as to make Strassburg, 82 miles above Mannheim, an important shipping center. It is claimed by such improvement much of the heavy shipping which is now compelled to stop at Mannheim and Ludwigshafen could be carried to the Alsace capital. While the project has not taken definite form, it has received some official sanction and has been pronounced practicable.

Further improvements of the Neckar have been from time to time exploited through the papers. The river, though an insignificant stream, has a considerable commerce as far as Heilbronn, in Wurtemberg. This commerce is facilitated, as it is on the Main, by a large chain in the bottom of the river, by means of which flat-bottomed steamers pull themselves up and down stream and tow barges from point to point. The chain passes up over the boat through gearing and back over the stern into the river.

It is stated that by the construction of a canal from Heilbronn to Stuttgart the latter city could be put into communication with the Rhine, and through it with the sea, and that the carrying out of such a project is within the range of possibility. That of using the Neckar in connection with a proposed canal to join the Rhine system with the upper Danube system, as is already done through the Main, has also been talked of, and is regarded as fairly practicable.

### HARBOR IMPROVEMENTS IN THE MANNHEIM CONSULAR DISTRICT.

Coming to that part of the Rhine in this consular district, and to the harbors and other improvements made upon it and upon the Neckar, in the district, it may be briefly stated that Mannheim is at the head of the heavier Rhine shipping and of the more improvements on the river. The city has by far the most varied and valuable river shipping interests of any inland city of Germany. Mannheim and Ludwigshafen, separated only by the Rhine, have a total present population of about 220,000. The location of these two cities has made them the center of important manufacturing interests as well as of distribution, in recent years, of large amounts of merchandise going to all parts of south Germany and adjoining countries.

Thus in 1875 the total freight tonnage by river to and from Mannheim was but 537,000 tons, while in 1902 the amount had risen to 5,731,000 tons. The river tonnage at Ludwigshafen during the same period had increased from 128,000 ton to 1,623,621 tons. In 1887 276,000 tons of grain of all kinds was received at the Mannheim harbors, while in 1902, 581,000 tons of wheat alone was received at these harbors. The aggregate of imported wheat brought to Mannheim for several years past has amounted to almost one-fourth of the total German importation of this grain. In petroleum, lumber, coal, and other merchandise the showing is scarcely less favorable.

Harbor improvement in and near the city has kept pace with this commercial growth, if it has not indeed outrun it. It has been recently published that an association of merchants in Berlin pointed out to the municipal authorities of that city that there has been a falling off of river freight per capita of population in that city during the period from 1891 to 1900, due, it is stated, to the insufficient warehouse and harbor facilities. The report states that but about 3,800,000 marks have been spent in Berlin for harbor improvements as against 13,500,000 in Cologne, 10,000,000 in Düsseldorf, and 50,000,000 at Mannheim. It will not be questioned that the municipal authorities at Mannheim and Ludwigshafen, the chambers of commerce of both cities, as well as private capital, have been alert to the value of ample harbor facilities to the two cities, and that large returns have come from the money so expended. Whether the amount so expended falls below or exceeds the sum named is perhaps a question. The improvements have gone on under different authority for nearly a century, and it would be impossible to ascertain the exact amount. I am assured it is probably above 50,000,000 marks.

### PLANS OF HARBORS IN THE DISTRICT.

As of possible assistance in some branch of the inquiry being made by the committee of rivers and harbors, I inclose herewith plans of the principal harbors of this consular district. In the explanations which follow as to these several harbors, reference will be made to these plans.

Plan A shows a bird's-eye view of the two cities, Mannheim and Ludwigshafen, and of the Rhine and Neckar rivers. The larger river is the Rhine, the smaller the Neckar. Ludwigshafen is on the farther side of the Rhine and has a population of about 70,000.

Plan B shows the harbors of the two cities, not including those at Rheinau, a suburb of Mannheim about 4 miles distant.

Plan C shows the Industrial Harbor (Industriehafen) also shown in plan B.

Plan D shows the harbors at Rheinau which do not appear on plan B.

Plan E shows the harbors at Ludwigshafen.

Plan F shows the harbors at Worms.

### BY WHOM CONSTRUCTED.

The harbor and other improvements at Mannheim, Ludwigshafen, and Rheinau may be conveniently classed under three groups, to wit: Those built by the State, that is to say, by Baden or Bavaria; those built by the State and the city together, and those built by private capital.

*First group.*—(Improvements made by the State. See plan B.) This group includes all the earlier and more extensive improvements, indeed all those shown on plan B, except the Industrial Harbor (Industriehafen). These improvements consist of retaining walls, wharfs, docks, large warehouses, railway sidings and terminals on both sides of the Rhine and the Neckar rivers. The harbors other than those on the open river consist of inner basins as follows:

(*a*) The Mühlau Harbor (Mühlauhafen) shown on plan B, having a length of 2,300 yards and a width of 130 yards with a water

area of somewhat more than 600 acres. This harbor was constructed during the years 1870–1875.

(*b*) The Connecting Canal (Verbindungscanal), having a water area of 29 acres and harbor walls of more than 3,350 yards length. This harbor was constructed in 1875–1878.

(*c*) The Inner Harbors (Binnen Hafen) between the Mühlau Harbor and the Neckar River. These two harbors have a water area of 26 acres and a combined length of wall amounting to 3,500 yards. These harbors were constructed in 1878.

The several harbors of this group have a combined length of wall amounting to between 20 and 21 miles. The inner basins have a depth of water corresponding to that of the two rivers. These basins are provided with locks as a protection to shipping and to the harbors in time of high water. For the most part the harbors are surrounded by warehouses, customs-houses, factories, and coal and lumber yards and are amply provided with facilities for the rapid transfer of cargoes and with a complete network of railway sidings and terminals.

*Second group.*—(Improvements made by the city and State together. See plan C.) The second group includes the Industrial Harbor (Industriehafen). This harbor was begun in 1897 and was completed in 1900.

It was constructed in a former channel of the Rhine (Altrhein), as will appear in plans B and C.

The project for the building of this harbor originated with the city of Mannheim, but the authorities of the State of Baden were asked to build the harbor as a matter of public interest to the State and especially to the state railways. The State declined to bear the cost of the undertaking, but after some negotiations agreed to bear a portion of the expense, and to provide especially for the following items:

(*a*) To surrender to the city certain lands belonging to the State and lying adjacent to the proposed improvement.

(*b*) To build the necessary locks to connect the harbor with the Neckar and through it with the Rhine.

(*c*) To keep the harbor in repair when constructed, and to provide for the expense of operating the locks and otherwise maintaining the harbors, including the making of all necessary railway sidings and terminals.

(*d*) To give to the city such legal rights as it might need to carry out the project, and especially the right to appropriate by legal process such private property as should be necessary in making the improvement.

The city, on the other hand, was to construct the harbor as a purely city undertaking, and to have the right to reimburse itself as far as it might be able from the sale of business sites along the harbor when completed.

Under an agreement in substance as above, the harbor was built at large expense and has a shore extent of nearly 4 miles. A large amount of manufacturing and other business has sprung up along the line of the improvement and the city still has a large area of land reserved for further extensions of the harbor when required.

The Industrial Harbor is connected with the Neckar by two locks, one at the upper end of Bonadies Island (Bonadies Insel), 9.20 meters wide, and one at the lower end of the island, 12 meters wide.

*Third group.*—(Improvements made by private capital. See plan D.) This group of improvements is located at Rheinau, a suburb of Mannheim, situated about 4 miles farther up the Rhine. Their construction was part of a project to buy large tracts of low waste land along the Rhine, and by filling and otherwise improving the same, to render them suitable for manufacturing and residence purposes. The harbors consist of extensive improvements on the open Rhine and of three separate basins, the total extent of walls amounting to several miles. The basins have a depth of water corresponding to the Rhine at that point and in ordinary stages sufficient for heavy barges and steamers.

The walls of these harbors are of brown sandstone and are exceptionally well built. As was expected, the tendency has been for manufacturing plants to locate in this locality and important interests are established there.

The company having this enterprise on hand became financially embarrassed, due for the most part to the general depression in business in Germany the past three years. The harbors are at this time in process of being turned over to the State of Baden.

With the transfer of the Rheinau harbors to the State, as is now contemplated, all the harbors of Mannheim will be practically under the management of the State, though the title to the Industrial Harbor (Industriegafen) is in the city, and extensions to the harbor when required will doubtless have to be made by the city. The State's management of the harbors is through the department of state railways.

The larger part of the land abutting on these harbors and in use by warehouses and transportation companies belongs to the State, as do the buildings and other structures on these lands. The property is simply rented to the occupants under long-term leases.

In some cases, the cranes and other appliances for transferring cargoes belong to the State, and in other cases to the tenants or to independent concerns which erect and operate these appliances as an industry by itself.

### THE LUDWIGSHAFEN HARBORS.

In the general description of the Mannheim harbors reference was made to the harbors at Ludwigshafen on the opposite side of the Rhine. From Plan E it will be seen that in addition to a long stretch of wall on the open Rhine, affording space for the tying up and unloading of a large number of boats, there are two basins connected with the Rhine. The larger of the two basins (the Luitpold Basin) has a wall extent of about 2,700 yards and is supplied with locks at the upper end. These harbors were constructed mainly by the State of Bavaria, in which Ludwigshafen is situated.

### HARBORS AT WORMS (PLAN F).

The improvement of the river at Worms, the principal Rhine town of Hesse, 13 miles below Mannheim, dates from about the year 1856, though the principal work was done from 1887 to 1893. This latter

work consists of two basins opening out to the Rhine (see Plan F). The larger of these two basins (the Flosshafen) has a total length of about 787 yards and a width of 65 yards, with a total water area of about 11 acres.

The smaller basin, known as the Handelshafen, is 547 yards long in its longest dimension, and has a water area of a little more than 8 acres.

These improvements cost in round numbers $523,000. Of this amount $402,000 was paid by the city of Worms, the balance being paid by the State of Hesse.

### HARBORS AT CARLSRUHE.

Extensive river improvements have been made recently at Carlsruhe, the capital of Baden, situated about 40 miles above Mannheim, but in the Mannheim consular district. The city, though about 2 miles from the Rhine, is connected with the river by canal and has a system of harbors, warehouses, etc., that represent a large outlay of money.

These harbors consist of three separate basins, the larger of which is about 1,200 yards long by 100 yards wide. These harbors are designed to accommodate lighter shipping in favorable stages of water. The expenses of these improvements were paid in part by the State and in part by the city of Carlsruhe.

### GENERAL SUMMARY.

Referring to the several questions in the department's circular of May 8, 1903, touching the matter of harbor improvements, I would say as respecting this consular district:

*Question 1.*—(*a*) By the Government, by municipal corporations, and by private concerns.

(*b*) No fixed uniform apportionment. Each case is determined by special agreement.

(*c*) No rule governing.

(*d*) The harbors of this district are for the most part, if not altogether, free harbors, no charges of any kind being made.

(*e*) The extent has varied greatly in this consular district. In the case of the Industrial Harbor (Industriehafen) of this city, the work was largely done at the expense of the city. In the case of the Rheinau harbors near the city, the project was a purely private one.

(*f*) There are no canalized rivers in this district.

(*g*) Usually by contract.

(*h*) The ordinary method of letting to the lowest responsible bidder.

*Question 2.*—In this city the State has from time to time constructed the larger part of the docks, wharves, warehouses, and railway terminals. The city bore the expense in the constructing of the Industrial Harbor.

*Question 3.*—This question can be answered only approximately. The depth of water in the Industrial Harbor may be taken as a fair standard of comparison for the harbors of the city.

Assuming 84.497 (84 meters and a fraction is the height above the sea level of zero on the harbor water guages) to represent the bottom of the Industrial Harbor as shown in profile drawings accompanying this report, the harbor authorities recognizing the following water stages:

Average summer stage, 89.222 (actual depth, about 4.725 meters).
Average yearly stage, 88.811 (actual depth, about 4.314 meters).
Average winter stage, 88.400 (actual depth, about 3.913 meters).
Exceptionally low stage (January, 1891), 86.347 (actual depth, about 1.95 meters).

*Question 4.*—Strassburg may be taken as the point farthest up the Rhine having a commerce of importance. This city is 437 miles from Rotterdam. The Rhine is, however, navigable for some distance above Strassburg. The river varies in depth and in width. At Mannheim it is about 1,300 feet wide and has a depth of from 12 to 25 feet in ordinary stages. At the Rocks of the Lorelei the river is much narrower and has a depth of about 70 feet.

*Question 5.*—I am able to state this increase only as applicable to the city of Mannheim. The figures may be taken as probably applicable to most Rhine cities.

| For the year— | Railway tonnage (in metric tons). | River tonnage (in metric tons). |
|---|---|---|
| 1860 | 220,000 | 240,000 |
| 1870 | 340,000 | 410,000 |
| 1880 | 838,000 | 960,000 |
| 1890 | 2,050,000 | 2,630,000 |
| 1900 | 3,900,000 | 5,330,000 |

*Question 6.*—This question is not easily answered, even approximately. The railway charges of the several state railways are not uniform, nor are the rates for water transportation. The Rhine rate, for example, is exceptionally low, due in part to competition of rival transportation companies and in part to the slight interference during the year to shipping on this river because of low water, ice, etc.

*Question 7.*—The apparent tendency is toward the further improvement of rivers by canalization, etc.

*Question 8.*—It would be difficult to obtain even fairly reliable information on this head. This city, Mannheim, is a comparatively young city, but the work of river improvement began almost a century ago and has been continued nearly ever since. The work has been done partly by the State, partly by the city, and partly at private expense. Large sums of money have been expended for repairs to already existing work. New structures have been built and old ones rebuilt. Changes in the harbors have frequently required expensive changes in the railway terminals and connections. It is stated that at least 50,000,000 marks have been expended in Mannheim for river improvements. This is regarded as a mere estimate and may be far under the actual amount paid out since the work began.

*Question 9.*—Probably accurate statistics except as to the value of tonnage. This could be ascertained only approximately, if at all.

*Question 10.*—There are no canalized rivers in this district.

*Question 11.*—The engineering work has been mainly—

(*a*) The straightening of the channels of the Rhine and Neckar.

(*b*) The building of long stretches of stonewall along these rivers for the purposes of keeping the water on its channel and otherwise facilitating navigation. These walls are in some instances vertical wharf walls and in some cases sloping walls of varying slope.

(*c*) In constructing large inner basins and inclosing them with similar stonewalls, and otherwise fitting them for the reception and storage of boats and the transfer of cargoes.

(*d*) In some instances in fitting these basins with locks to prevent injury to the basins and to shipping in time of high water or ice.

H. W. HARRIS,
*United States Consul.*

MANNHEIM, *July 17.*

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Harbors at Carlsruhe
General summary (answers to questions in department circular in their order).
Exhibits:
Newspaper clippings attached hereto, referred to
Sundry prints of harbors, etc., forwarded to department under other cover.

NOTE.—The illustrations and papers referred to in the above report have not been reproduced as a part of this document.

CONSULATE OF THE UNITED STATES.
*September 16, 1903.*

Hon. FRANCIS B. LOOMIS,
*Assistant Secretary of State, Washington, D. C.*

SIR: As of possible interest, I have the honor to inclose herewith a little statement of a meeting recently held in this city by the German and Austro-Hungarian Association for Inland Navigation, with a brief summary of the topics under discussion.

I have thought the matter might have some interest in connection with the subject of river and harbor improvement now being considered by the committee of Congress on that subject.

The speeches delivered at the meeting are, or will be, in print and can be obtained on application to Verlag von A. Troschel, Berlin-Grunewald.

I inclose herewith a separate list of the principal addresses, with the names of the parties who gave them.

I have the honor to be, sir, your obedient servant,

H. W. HARRIS,
*United States Consul.*

## MEETING OF THE GERMAN AND AUSTRO-HUNGARIAN ASSOCIATION FOR INLAND NAVIGATION.

[Deutsch-Oesterreichisch-Ungarischer Verband für Binnenschiffahrt.]

The most notable meeting held in Europe this year in connection with the question of river and canal improvement and navigation was a three days' convention of the "German and Austro-Hungarian Association for Inland Navigation" (Deutsch-Oesterreichisch-Ungarischer Verband für Binnenschiffahrt), held at Mannheim for the three days beginning with September 9 and ending September 12. The association was organized seven years ago, this being its sixth meeting. Four of the meetings have been held in Germany, the other two at Vienna and Budapest.

The association announces as among the objects of its organization that of promoting "the improvement and perfecting of the more important waterways for freight transport in middle Europe and the establishing of a point of union for all friends of a progressive industrial development of the two friendly lands, Germany and Austro-Hungary."

The meeting which just closed at Mannheim was made up of nearly 300 delegates, representing the principal state and municipal governments within the two Empires, boards of trade, chambers of commerce, and large transportation companies. The Prussian Government was represented by General Secretary Ragoczy, Privy Councilor Witting (chairman of the association), and other prominent officials. The Austro-Hungarian Empire was represented by several cabinet officers and heads of departments.

It was preeminently a meeting of men of affairs who have taken a leading part in the river, harbor, and canal improvement that has formed so conspicuous a part of the recent industrial development of Germany, and to a lesser extent of that of the Austro-Hungarian Empire. A development which would seem already to have utilized nearly every available waterway of Germany as an avenue of trade; and which has pushed canal construction far beyond that of any other country and which expressed in figures gives startling totals of freight carried by water and of money expended for canal and river improvement. And yet unquestionably the principal interest of the meetings centered on the subject of further improvement. "Navigare necesse est" was the sentiment announced by General Secretary Ragoczy in his paper, and it was the sentiment of all the deliberations of the convention.

The relation of good shipping facilities to manufacturing, to agriculture, to railroads, and to other great industries was emphasized and various projects outlined for the improving of these facilities in the two Empires. Special stress was placed upon a system of canals to connect the Rhine and Danube systems through the River Main and through the Neckar River from Mannheim to the upper Danube. The latter improvement, it was pointed out, would open up a large area of Wurttemberg to river traffic with the Rhine and likewise afford an outlet for Roumanian and Galician petroleum in a region of west Germany now supplied for the most part by American oils.

Figures were given to show that Germany's dependence upon America for petroleum might be a serious menace in the event of war, and that at her present rate of consumption of petroleum, an increase in cost of one-quarter of a cent per liter means an annual outlay to Germany of 10,000,000 marks. It was urged that from an economical standpoint Germany should be prepared to reach all the European oil fields.

Doctor Vosberg-Rekow, of Berlin, in a paper under the title of "The Far-reaching Effects of Transportation Facilities," referred to the freight rate at which ore is carried in the United States. He stated that the German freight rates were more than three times as high as American freight rates, and that the notable advance in the United States in industrial lines is due to the far closer unity of forces there in any given field of industry.

Doctor Gothen, a member of the German Reichstag, referring also to American freight rates for carrying ore, said that while the iron industry in the United States was to be taken earnestly, it was not to be taken too gloomily.

An extra from the address of General Secretary Ragoczy on "Sea Transportation and Inland Transportation" may be taken as perhaps covering broadly the range of topics discussed by the association and the views entertained by its members. Undoubtedly the general secretary expressed the widespread sentiment of the German manufacturer and shipper as well as that of the German statesman touching the question of river and canal improvement. He said (a translation): "What inland navigation lacks is equal recognition in public opinion with other agencies of traffic, especially with railway lines and sea transportation; a fostering care on the part of state authorities and local communities; the modernizing of waterways improved under plans now antiquated, especially in east Prussia; the establishing of connections between the several large streams through canals; the doing away with competition on the part of the state railway lines, and the laying aside of excessive shipping taxes.

"A many-sided programme," he said, "but a programme the carrying out of which will not only tend to make possible and to guarantee to German inland navigation a continued participation in the exchange of merchandise, but tend to promote the national welfare as well."

Statistics were cited in the same address to show that in 1900 the 43,000 kilometers (a kilometer is approximately three-fifths of a mile) of German railways carried 76 per cent of the total freight tonnage of Germany, while the 10,000 kilometers of waterways in the Empire carried 24 per cent, or a greater amount than the total railway tonnage in Germany in 1875. It was shown to what proportions Rhine and other larger river shipping had grown, and the important relation of this shipping in Germany with ocean transportation in which the Empire had taken so commanding a position. But that the tendency had been to overlook the importance of river shipping as compared with sea and railway transportation.

As might have been expected, the question of state control of waterways analogous to that of German railways was raised. It found, however, but few supporters in the association. Secretary Ragoczy pronounced state control of these waterways as a thing to be strongly opposed in the interest of a sound public policy.

The convention accepted with favor the view that river and canal improvement should follow some well-directed plan that should look to the eventually forming of a systematic network of waterways, and that this improvement should not be left so largely to local interest or caprice as it had been in the past. Reference was made to the want of such plan in German railway construction, and the absence of German and continental railway systems and main lines as distinguished from mere collateral lines or feeders.

With much earnestness it was urged that the need of Germany was for a broad internal commercial policy, to be worked out through a branch of the Government familiar with the needs of traffic, and not merely by the fiscal department. The true relation of railway lines and waterways in Germany was not one of hostility, but of interdependence. Under a wise internal system the railway would cease to be, as now, the avowed competitor of the waterway.

Just how competition between state railway lines and private river transportation companies is to be done away with was not clearly indicated. It was referred to as a difficult problem not to be best solved by state ownership of waterways or by a combination among river transportation companies under one management. How far its solution is, in fact, possible was certainly not made plain.

It was not hard to detect in some of the speeches made, as in much that is published on the subject of transportation facilities in Europe, a certain undertone of complaint that some such traffic arrangements as those under which ore is hauled from the Lake Superior region to Pennsylvania, or grain carried at a low freight rate from our middle Western States to the eastern markets, can not be more generally secured on the Continent. Commercial treaties, it was pointed out, were valuable only when supplemented by traffic facilities.

Interesting discussions on the construction of river harbors formed a part of the programme of the congress, Director Eisenlohr, of the Mannheim department of public construction, reading the principal paper on the subject.

Among the resolutions adopted by the congress was one to the effect that the further improvement of the Main and Neckar rivers by canalization, so as to connect with the upper Danube system, and the improvement of the Rhine to Strassburg are pressing industrial necessities.

The congress adjourned to meet in Stettin in 1905.

H. W. Harris, *Consul.*

Mannheim, *September 17, 1903.*

SUBJECTS OF PAPERS PRESENTED AT MEETING OF THE GERMAN AND AUSTRO-HUNGARIAN ASSOCIATION FOR INLAND NAVIGATION.

"Zur Frage der Schiffahrtsabgaben auf künstlichen Wasserstrassen," von Handelskammer-Syndikus Doctor Behrend, Magdeburg.

"Bericht über die bisherigen Ergebnisse des Schifsverkehrs am Eisernen nischen Amtes des Vereines für Hebung der Fluss- und Kanalschifffahrt in Orsova.

"Die Einrichtung der Grossschiffahrt auf dem Neckar und die Verbindung von Rhein und Donau durch Württemberg," von Bürgermeister Doctor Weiss, Eberbach.

"Studien über die Verbesserung der Schiffbarkeit der Donau von Kelheim bis nach Ulm," von Eduard Faber Kgl. Bauamtmann und Vorstand des tech-

nischen Amtes des Vereines für Hebung der Fluss- und Kanalschifffahrt in Bayern.

"Seeschiffahrt und Binnenschiffahrt in Deutschland," von Generalsekretär Ragoczy, Berlin.

"Industriehäfen mit besonderer Berücksichtigung der Anlagen am Rhein," von Stadtbaurat Eisenlohr, Mannheim.

"Die Interessengemeinschaft von Eisen- und Wasserstrassen in Baden," von Doctor Emminghaus, Handelskammer-Syndikus, Mannheim.

"Wasserwirtschaft und Landwirtschaft," von Ingenieur Emil Alchoff, Hannover.

"Die Fernwirkung der Verkersmittel," von Direktor Doctor Vosberg-Rekow, Berlin.

"Ueberblick über den gegenwärtigen Stand der Bestrebung zur Förderung der Fluss- und Kanalschifffahrt im Deutschen Reiche," von Generalsekretär Ragoczy, Berlin.

"Die Bedeutung der Donauwasserstrasse für den Pretrolenmverkehr," von Doctor Ditthorn, Regensburg.

"Der Stand der Fluss- und Kanalschifffahrt in Oesterreich Ungarn," von Professor Oelwein, Wien.

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*Mr. H. W. Harris to the Department of State.*

CONSULATE OF THE UNITED STATES,
*September 29, 1903.*

RHINE TRAFFIC.

Incloses translation of article recently appearing in the Badische Landes Zeitung, of Mannheim, referring to the Rhine traffic in the more important Rhine towns, especially for the year 1902.

The subject-matter of the article fairly covered by consul's report for Committee on Rivers and Harbors. The translation is sent as supplementary to the report and as of possible interest.

CONSULATE OF THE UNITED STATES,
*September 29, 1903.*

Hon. FRANCIS B. LOOMIS,
*Assistant Secretary of State, Washington, D. C.*

SIR: As supplementary to my report on the Rhine and its harbors for the Committee on Rivers and Harbors I have the honor to inclose herewith a translation of an article on the same subject recently published in the "Badische Landes Zeitung," of Mannheim.

The points covered in the article were for the most part referred to in my report, but the translation may have some interest as supplementary to the report.

I have the honor to be, sir, your obedient servant,

H. W. HARRIS,
*United States Consul.*

[Translation.]

FREIGHT TRAFFIC IN THE GERMAN RHINE HARBORS.

Since the middle of the seventies the Rhine has, in consequence of the removal of the Rhine charges and the carrying out of river improvements, developed into one of the most magnificent waterways of the world. Many new harbors have sprung up and have attracted to themselves an important traffic.

### DUISBURG.

Among the Rhine harbors, Duisburg shows in the year 1902 the largest river traffic, amounting to over 6,620,000 tons. As in the case of Ruhrort, the freight handled at Duisburg consists largely of coal, which forms 58.5 per cent of the total traffic. The ore traffic decreased, in consequence of the present industrial crisis, about 200,000 tons. The total traffic in this product reached scarcely 800,000 tons.

Likewise the arrivals of lumber show a falling off from 324,000 tons in the preceding year to 265,000 tons in 1902. As against the year 1900, the falling off amounts to 135,000 tons. This large decrease in lumber brought into this port is a direct consequence of the poor business conditions in the Rhenish Westfalian region.

On the other hand, the grain received at the port shows an increase from 576,000 tons in 1901 to 616,000 tons in 1902. The trade in grain shows a tendency to develop, especially in the new harbor, with its ample protection from high water. Several warehouses, mills, and 17 elevators furnish evidence that Duisburg is one of the most important centers of grain traffic in Germany.

Of importance is it also to note that the shipments of manufactured iron of all kinds rose from 47,000 tons in 1901 to 92,000 tons in 1902. These figures show the necessity of our industries in a time of dull home market to depend upon a foreign market, where larger demands exist. The amount of raw clay received in 1902 was 31,000 tons; of petroleum, 27,000 tons.

In the handling of miscellaneous freight, Duisburg's position was much less important than in that of heavier freight. In 1901 the amount of miscellaneous freight was 104,000 tons. In respect to this class of freight, Duisburg had fifth place among the German Rhine towns. Düsseldorf itself has overtaken Duisburg since the putting into operation of its new harbors and quays. As the region back from Duisburg is at least equally valuable as a market as that adjoining Düsseldorf, the cause for the slower development of the former is to be found in the insufficient loading and unloading facilities at Duisburg. Düsseldorf and Cologne have ample river warehouses, sheds, and cranes, which are in the main used only for miscellaneous freight. This class of freight is not, as a rule, forwarded in entire boat loads to single harbors, but is usually loaded in cargoes intended for different harbors where the loading and unloading can be rapidly effected.

If, therefore, Duisburg will increase its miscellaneous freight business, the increase of facilities for the transfer of cargoes is a pressing necessity. Perhaps the building of the new harbor will afford opportunity to construct freight sheds at the point where it unites with the Rhine.

### RUHRORT.

The freight handled at Ruhrort shows a falling off from the previous year of 460,000 tons. In Ruhrort coal is the principal item to even a greater extent than at Duisburg, and forms about 71 per cent of the total freight traffic. Ten dumps are in operation for the transfer of entire carloads from the railways to boats. In addition

to these are ample facilities by which coal can be loaded from coal sheds by means of chutes direct into boats.

As in Duisburg, so at Ruhrort the handling of ore shows a falling off, the total amount handled being 1,055,000 tons, the falling off amounting to 210,000 tons. There is a notable falling off in both harbors in the amount of iron ore received from up the river; that is, from Loraine. In Ruhrort the amount of Loraine product received fell from 144,000 tons in 1899 to 64,000 tons in 1902, and the amount received at Duisburg fell from 104,000 tons in 1899 to 10,000 tons in 1902.

The amount of ore received from downstream—that is, from Norwegian, Swedish, and Spanish ore—amounted, on the other hand, in Ruhrort in 1902 to 980,000 tons, and in Duisburg to 770,000 tons. The falling off in the receipt of Loraine ore is in part due to the shutting out of the Oberlahnstein district from the special ore rate of the Prussian railway management. In order to equalize the advantage which the inland works had through the special ore rate, and through their position in the coal territory, the blast furnaces on the lower Rhine were restricted to foreign ore. Had not several of these works already their own mines in Loraine, the shutting off of the supply of ore from Loraine would have been wholly welcome.

The receipts of lumber in Ruhrort consist principally in already-prepared mining timber. Raft timber has greatly decreased in quantity. The total receipts amounted in 1902 to 82,000 tons. The grain trade in Ruhrort, as compared with Duisburg, is of minor importance. The receipts for some years past have fallen off, and were in 1902 only 54,000 tons.

### MANNHEIM.

In third place among the Rhine harbors stands Mannheim, with Rheinau Harbor. It owes its extraordinarily rapid development to its position at the upper end of the greater Rhine traffic and to the far-seeing freight-rate policy of the state railway management of Baden.

The total river freight transfers amounted in 1902, in round numbers, to 5,730,000 tons. The principal item of freight at Mannheim is also coal. In the year 1902, 2,230,000 tons of coal were unloaded from boats at Mannheim and either stored in coal yards or reloaded on railway cars. Next to coal, grain is the most important article received at Mannheim. Not less than 860,000 tons of grain were brought there in 1902. Of this, 664,000 tons was wheat alone. From the total wheat import of Germany, about one-fourth comes to Mannheim, making it the most important wheat market in Germany.

Highly important also are the receipts of petroleum, which amounted in 1902 to 102,000 tons. In miscellaneous freight, Mannheim is far above all other Rhine harbors. In 1901 more than 417,000 tons of this class of freight were received there. Far in the background stands Cologne, with 267,000 tons of miscellaneous freight; Düsseldorf, with 147,000 tons; and Ludwigshafen, with 126,000 tons; and in the fifth place stands Duisburg, with 114,000 tons.

Among away-going freights, timber holds an important place. This consists in part of raft timber brought down the Neckar and assembled in rafts and sent down the Rhine, and in part of timber cut into lumber and then shipped. The lumber shipments amounted

in 1902 to more than 198,000 tons. Salt to the amount of more than 147,000 tons was also shipped from Mannheim in 1902.

### LUDWIGSHAFEN.

The fourth place among the Rhine harbors is held by the Bavarian city of Ludwigshafen, situated opposite Mannheim. The total freight traffic of this place amounted in 1902 to 1,624,000 tons, showing a falling off of 8 per cent from the previous year. This falling off consisted for the most part in reduced receipts of coal, 195,000 tons; raw iron, 34,000 tons; ore, 12,000 tons; and grain, 59,000 tons. There was a marked increase, however, in receipts of raw sugar, the amount in 1902 being 61,000 tons, as against 14,000 tons in the previous year. This is due to the growing preference of the south German sugar refineries to the use of the waterways for the carrying of raw sugar from the north German factories.

### MAINZ, GUSTAVSBURG, ETC.

At the mouth of the Main, the harbors of Mainz, Gustavsburg, and Castel group themselves. Of these, Gustavsburg shows the greatest traffic. Unfortunately the statistics showing the trade of the harbor in 1902 are not yet at hand. In 1901, Gustavsburg had a total river traffic of 1,140,000 tons. Of this amount 849,000 tons were coal. In Mainz are handled the more valuable freights. The receipts of coal there amounted to less than 67,000 tons; the total traffic to 680,000 tons. Next after Mainz came Castel with a total freight traffic of 488,000 tons. Worthy of note is it that Castel, at the mouth of the Mainz, is the chief outgoing point for timber rafts. In 1900, 294,000 tons of raft timber passed from the Main into the Rhine. The Neckar, the second river of importance carrying timber rafts to the Rhine, fell far behind the figures shown by the Main. For the year 1900, 93,000 tons of raft timber came from the Neckar into the Mannheim harbors.

### COLOGNE.

Cologne holds sixth place among the Rhine harbors with a river traffic of 800,000 tons. In proportion to the size of the city, this amount is a modest one. However, it is to be kept in mind that the actual bulkier freights are largely wanting at Cologne, among these of importance is the handling of grain alone, amounting in 1902 to 135,000 tons. Of lumber, the amount was 68,000 tons, while of coal, the principal article of freight on the Rhine, the amount was in 1902 but 50,000 tons.

Of much importance, however, is the miscellaneous freight which in 1901 amounted to more than 267,000 tons.

Seagoing transportation on the Rhine stops for the most part at Cologne. This branch of river navigation for that reason is relatively more important at that city than at any of the other Rhine cities. It amounted in 1902 to about 95,000 tons; that is to say, to more than one-tenth of the total river trade of the port. The water conditions of the Rhine do not at present admit of an extension of direct seagoing traffic from this point. In order to secure a really serviceable direct sea connection a deepening of the Rhine to at least 6 meters would be necessary. Whether the expense required for this would be warranted appears questionable. At any event, such a deepening of

the navigable water of the Rhine to Cologne merely would scarcely be profitable, as the heavier freight indispensable for sea transport, such as coal and ore, is wanting at Cologne.

### DÜSSELDORF.

Düsseldorf within the past few years has developed a somewhat important river trade, especially since the completion of its new harbors and quays. After a previous falling off in this trade it rose in 1902 to 661,000 tons. As against the preceding year this was an increase of 13.5 per cent. The principal single articles are lumber, amounting to 148,000 tons, sand and gravel amounting to 120,000 tons, and grain amounting to 77,000 tons. The amount of miscellaneous freight handled in 1901 was 149,000 tons.

### STRASSBURG.

The Rhine transportation at Strassburg is of importance although at present wholly dependent upon the stage of the water. In 1902 the amount of freight handled was 496,000 tons. Of this 265,000 tons were coal, 130,000 tons grain. Inclusive of canal transportation the total freight moved by water at Strassburg in 1902 amounted to 794,000 tons. Strassburg's river transportation will be a factor of actual importance only when by improvement of the upper Rhine a sure and sufficient waterway is open between Mannheim and Strassburg.

### CARLSRUHE.

Carlsruhe, the youngest of the Rhine harbor towns, has attained a not unimportant traffic. Heretofore the capital and residence city of Carlsruhe, some 5 kilometers from the Rhine, shared but little in the advantages of this cheap waterway. The Maxau and Leopold harbors are too far from the city and did not have modern facilities for the transfer of cargoes. After the opening of the new Rhine harbor on the 1st of May, 1901, Carlsruhe entered the ranks of important Rhine harbor cities.

Naturally Carlsruhe, with its 212,000 tons of freight handled in 1902, stands somewhat in the background as compared with the Rhine harbors of Mühlheim, Uerdingen, Worms, Wesel, Lauterburg, Neuss, Krupp harbors at Rheinhausen, the loading points of the Basalt Corporation at Linz, near Cologne, and the Phoenix furnaces at Laar near Ruhrort. Yet, in all probability, Carlsruhe will take front rank among these harbors as soon as the improvement of the upper Rhine becomes a certainty.

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## NUREMBERG, BAVARIA.

### REPORT ON CANAL AND RIVER IMPROVEMENTS IN THE CONSULAR DISTRICT OF NUREMBERG.

CONSULATE OF THE UNITED STATES,
*August 4, 1903.*

I. (*a*) In the Kingdom of Bavaria all works on public rivers which have for their purpose the improvement of navigation and the floating of wood are made by and at the expense of the Royal Govern-

ment. As regards works which have for their purpose the protection of the embankments against damages or inundations, the owners of the respective territory have to make contributions, either in cash or by performing work, like furnishing horses, carrying stones, sand, or other material, etc.

Private rivers, that is to say, rivers running through private territory only, have to be kept in order and repair by their owners; all necessary repairs and improvements are to be borne by them.

(*b c*) As a rule, the apportionment of the cost of works done for the protection of embankments and the erection of dams against high water is divided so that the Royal Government, the district administration, and the interested private parties or corporations pay each one-third of the costs.

(*d*) No freight dues are raised as yet on public rivers in Bavaria. But, for the use of canals and canal harbors and wood-floating harbors, certain dues are raised, as, for instance, canal dues, landing dues, crane dues, ferry dues, wharf-track dues, warehousing dues, etc.

The amount of these dues has been fixed so that the capital expended for these improvements will by and by be fully redeemed.

(*e*) As a rule necessary improvements are executed by the Royal Government, and if local interests are to be promoted those parties especially benefited thereby have to make apportionate contributions. Canalized rivers do not exist yet in Bavaria, but it is contemplated to canalize a part of the river Main which flows through my consular district. Through my consular district runs also the so-called "Ludwigs-Donau-Main Canal," which connects the river Main with the river Danube.

(*f*) According to an imperial law tolls on natural waterways may only be raised for using the special buildings or plants which were erected and are destined for the furthering of traffic. Such tolls, as well as those for using artificial waterways like canals, which belong to the Government, may not exceed the cost of the erection and ordinary maintenance of such buildings or plants, and are to be paid into the general treasury. Canal dues are therefore raised on the aforesaid Ludwigs Canal. They amount to 1 pfennig (about one-fourth of a cent) per 1 kilometer (0.62 mile) and 1,000 kilos (2,204 American pounds). Only loaded ships are subject to such dues.

(*g*) Works on waterways executed by the Royal Government are almost exclusively done by hired labor, only in exceptional cases they are given to a reliable contractor, i. e., where the work to be done is such that it can easily be controlled and supervised.

(*h*) Whenever works are carried out by contract certain regulations issued by the Royal Government are in force, of which I inclose copies. As a rule small works, the probable cost of which does not exceed 2,000 marks ($476), can be given by the government officer to any reliable contractor, especially when those works are urgent. For large works tenders are to be submitted, the one who hands in the lowest offer receives the order, provided he is a reliable man of good standing. Preference is always to be given to German, if possible, Bavarian or local contractors. Foreigners may only get orders after permission from the royal state ministry has first been obtained. Bonds are only required in cases where the execution of the

work is to be finished within a certain time. As a rule, the bond should not exceed 10 per cent of the contracted sum.

II. All improvements, including docks, wharves, terminals for freight, etc., are built by the Government, but the communities benefited by such improvements have to contribute toward the cost of the same; for instance, when a short time ago a harbor was built at the city of Marktbreit, on the river Main, three-fourths of its cost was borne by the Government and one-fourth by that city.

Sometimes the ground necessary for making the improvements is to be ceded gratis by the respective communities, or building material is to be supplied gratis, or the communities have to pay the wages. An agreement of some sort is always arrived at by the Government with the communities benefited by such improvements.

III. The navigable depth at mean low water of all the leading canal harbors I was unable to ascertain. There is no range of tide in this inland canal. With regard to the Ludwigs Canal harbor at Nuremberg I was told that it possesses a depth of 58 inches.

IV. The river Main, which partly flows through my consular district, has been greatly improved lately so that between the cities of Aschaffenburg and Kitzingen, a distance of 124 miles, it has a navigable depth of 28 inches at mean low water, and a width of 98 feet. Chain steamers, or steamers propelled by chains, with a draft of 22 inches are thus enabled to pass there.

The principal canal in Bavaria is, as already stated, the Ludwigs Canal, possessing a length of 107 miles. At normal times its depth is 58 inches, its width 52 feet.

The principal river in Bavaria, which divides this kingdom into almost two equal halves, is the Danube. Near Passau, Bavaria, the Danube going outward toward Austria begins to be navigable for large steamers and heavy freight boats, and, therefore, from that city it forms an excellent waterway through the Austro-Hungarian Empire to the Black Sea. It is largely used to carry Hungarian grain to the aforesaid city of Passau, Bavaria, whence it is transported by rail to other places in southern Germany. Within this kingdom the Danube begins to be navigable for small-sized freight boats at the city of Kelheim, where the aforesaid Ludwigs Canal runs into it, thus forming a connection by water between the two rivers—Main and Danube—in Bavaria.

V. While the freight carried by railways in Bavaria is increasing from year to year, the traffic on waterways is very small. The following figures prove this plainly:

(*a*) *Railroad traffic in Bavaria.*

| In the year | American tons. |
|---|---|
| 1896 | 11,745,984 |
| 1897 | 12,675,600 |
| 1898 | 13,916,842 |
| 1899 | 14,511,633 |
| 1900 | 15,367,509 |
| 1901 | 14,764,622 |

(*b*) *Steamers propelled by chains on the river Main, opened in the year 1898.*

| | American tons. |
|---|---|
| 1898, 374 ships loaded with | 10,980 |
| 1899, 755 ships loaded with | 28,037 |
| 1900, 1,300 ships loaded with | 47,253 |
| 1901, 1,566 ships loaded with | 63,132 |

The number and loads of ships not pulled by such chain boats was not ascertainable.

*(c) Traffic and receipts of the Ludwigs-Donau-Main Canal.*

| Average during the following years. | Traffic. | | | Receipts. | | | | Per 1 kilometer (0.62 mile). | | Percentage of expenses to receipts. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number of boats. | Number of rafts. | Tonnage. | Income. | Expenses. | Surplus. | Deficit. | Income. | Expenses. | |
| | | | *Tons.*[a] | *Marks.* | *Marks.* | *Marks.* | *Marks.* | *Marks.* | *Marks.* | *Per ct.* |
| 1852–1854–55 | 2,968 | 395 | 110,006 | 241,783 | 156,994 | 84,789 | ..... | 1,403 | 911 | 64.93 |
| 1855–56 1859–60 | 3,901 | 1,634 | 151,754 | 325,054 | 192,478 | 132,576 | ..... | 1,885 | 1,117 | 59.21 |
| 1860–61–1864–65 | 4,709 | 3,286 | 163,340 | 240,608 | 231,821 | 8,787 | ..... | 1,406 | 1,345 | 96.35 |
| 1865–66–1870 | 2,987 | 2,052 | 114,151 | 169,106 | 346,082 | ..... | 176,976 | 981 | 2,007 | 204.65 |
| 1871–1875 | 2,645 | 2,151 | 133,253 | 173,430 | 309,586 | ..... | 136,156 | 1,006 | 1,796 | 178.51 |
| 1876–1880 | 2,180 | 1,188 | 103,221 | 129,266 | 317,105 | ..... | 187,839 | 750 | 1,839 | 245.31 |
| 1881–1885 | 1,839 | 945 | 90,102 | 105,311 | 293,792 | ..... | 188,481 | 611 | 1,704 | 278.97 |
| 1886–1890 | 2,306 | 1,070 | 101,682 | 108,543 | 233,443 | ..... | 124,900 | 630 | 1,354 | 215.07 |
| 1891–1895 | 2,104 | 1,132 | 84,167 | 98,143 | 201,105 | ..... | 102,962 | 569 | 1,166 | 204.91 |
| 1896–1900 | 2,630 | 999 | 135,498 | 135,706 | 194,799 | ..... | 59,093 | 987 | 1,130 | 143.54 |
| 1901 | 2,259 | 699 | 113,108 | 125,195 | 196,681 | ..... | 71,486 | 726 | 1,141 | 157.10 |

[a] 1 German ton equals 2,204.6 American pounds.

1 German mark equal to 23.8 cents.

VI. Both the railroads and the aforesaid Ludwigs Canal and the rivers Main and Danube are the property of the Royal Government. With regard to canal and river navigation the Government has not fixed any freight rates, however. Anyone can transport freight on said canal or rivers or arrange with some shipper to carry freight for him without government dues. The Government raises only certain tolls and dues, as already described under I (*f*) of this report.

A comparison between rates of freight by railway and by waterways can, therefore, not be drawn. Besides, it would be useless, as, so far, neither the aforesaid Ludwigs Canal nor the river Main have been any earnest competitors for the Bavarian railroads.

For this very reason it is contemplated to improve these waterways, and a special association was formed ten years ago in Bavaria for that purpose under the title of "Association for the Promotion of Canal and River Navigation in Bavaria." This association has just worked out and finished a very valuable report on this subject, which I was fortunate enough to secure and which I inclose herewith. It contains a plan how to connect the two large rivers Rhine and Danube by way of the aforesaid Ludwigs Canal and by a canalization of a portion of the river Main.

It contains all the technical details, with illustrations, and also estimates of the cost of the works.

VII. The aforementioned association is the best proof that there is a strong tendency in Bavaria to develop inland waterways. The protector of this association is the hereditary crown prince of Bavaria, who for ten years has been present at nearly all the meetings of this association.

VIII. Six million five hundred and eighty-seven thousand four hundred and nine dollars have already been expended for the aforesaid Ludwigs Canal and $1,366,108 for the regulation of the river Main and the chain-boat navigation.

Detailed figures as to the cost of improvements and construction, also as to operating and keeping in repair canals, locks, dams, etc., I was unable to obtain.

I refer, however, to the foregoing table on "Traffic and Receipts of the Ludwigs Canal," which contains the annual cost of operating and keeping in repair said canal per 1 kilometer (0.62 mile) during the past fifty years.

IX. The Kingdom of Bavaria issues every year a report on their railways and canal and river navigation. I am, however, unable to obtain it at present.

Concerning the yearly average tonnage handled on all stations of the Ludwigs Canal during the years 1896 to 1900 the following figures were given me:

| | Number of ships. | | Tonnage. |
|---|---|---|---|
| | Total. | Empty. | |
| Arrived: | | | *American tons.* |
| In the direction of the Main | 990.2 | 119.2 | 86,599.05 |
| In the direction of the Danube | 1,254.4 | 780.6 | 35,122.98 |
| Departed: | | | |
| In the direction of the Main | 1,244.4 | 270.2 | 95,245.99 |
| In the direction of the Danube | 1,161 | 791.4 | 24,530.44 |
| | 4,650 | 1,931.4 | 241,498.46 |

X. The Ludwigs Canal possesses a length of 107 miles. At normal times its depth is 58 inches, its width 52 feet. It has 101 locks. The locks have an available width of 15 feet 2 inches, an available length of 105 feet 3 inches, and the depth on sills of each lock is 58 inches.

The river Main is hemmed at three places between the cities of Bamberg and Aschaffenburg; the reach at those three places at mean low water is 10 feet, 13 feet, and 4 feet, respectively. The kind of material used and the approximate cost of each structure could not be given me.

XI. New harbors are dug out with dry baggers whenever there is sandy territory. There are constantly steam baggers on work on the rivers Main and Danube. Natural rocks grown in the latter river have been removed lately by dynamite.

Respectfully submitted.

GEORGE E. BALDWIN,
*United States Consul.*

NOTE.—The documents referred to in the above report have not been reproduced as a part of this document.

## STETTIN, GERMANY.

### HARBOR AND RIVER IMPROVEMENTS.

CONSULATE OF THE UNITED STATES,
*September 5, 1903.*

*Question 1.*—"In what manner is the cost of river and harbor improvements provided?

(*a*) "Are improvements made by the Government or by private corporations and individuals?"

The costs for improving such harbors as are used as ports of arrival for all vessels and open to trade in general, and not of merely local value, are paid for by the Government. Expenses for improving such harbors as are of purely local value and use are at times partly paid by the Government. Harbors are divided into three classes, as follows:

(1) Fiscal or public harbors, which as a rule are cared for at the expense of the Government.

(2) Parish or local harbors, built for the general benefit of a city or community.

(3) Private harbors, at the cost of the benefited corporations or individuals.

(*b*) "Is there any apportionment of the cost between the central Government and localities or individuals immediately or exceptionally benefited?"

The costs for improvements, if not of a nature that limits its advantages to a city or a particular district, are at times paid for by those individually benefited, either in a lump sum or by a special fee based on the value of the service to be rendered, and of sufficient amount to pay the interest, and eventually the cost of the improvements. In the case of local and private harbors, according to agreement with those benefited.

(*c*) "If there is such apportionment, what is the usual proportion?"

The apportionment of improvement expenses depends upon the value of service to be rendered, and varies.

(*d*) "Is the expense, or any portion of it, paid by tonnage or port dues? Is there any relation between such dues and the expense of improvements made?"

The expenses for maintaining and improving general public harbors, the interest on capital invested, and the annual sum to be paid into the sinking fund are raised by harbor dues. The limit of harbor dues is defined in article 54 of the constitution of the German Empire, dated April 16, 1871, and reads in part as follows:

> At all seaports and on all natural and artificial waterways of the Federal States (comprising the Empire) the merchant marine of the several Federal States are to be equally admitted and treated. The fees collected at seaports from sea vessels or their cargoes for the use of the harbor and harbor facilities should not exceed the necessary expenses of maintaining such harbor.
>
> On all natural waterways a fee can only be collected for the using of such facilities as lighten navigation. These fees, as well as the fees for plying artificial waterways, which belong to the Government, should not exceed the expenses of improving and maintaining same. These regulations apply to log rafting, if conducted on streams that are being navigated.
>
> The right of levying a higher fee on foreign vessels and their cargo, as is collected from ships of the Federal States, is invested in the Empire, and not in any one particular State.

(*e*) "When improvements of projects are promoted locally in the respective ports, to what extent are they improved by municipalities and by private corporations and individuals?"

This question is answered under (*b*).

(*f*) "Are tolls charged upon traffic upon canals or canalized rivers? If so, are the amounts so collected expended in waterway improvements, or are they paid into the general treasury?"

A toll is charged upon traffic upon canals and canalized rivers, and reverts to the Government to the credit of waterways.

(*g*) "Are the works, when executed by the Government, carried out usually by contract or by hired labor?"

Large works or improvements carried out by the Government are usually let by contract and done under government supervision; small works are carried out through hired labor by the Government.

(*h*) "If carried out by contract, what is the method of letting the contract?"

The letting of work by contract depends upon the amount involved, can be let without bids, by limited or public bids. Specifications and plans are furnished by the Government.

2. "In case improvements are made in harbors, to what extent does the Government, or other agency making the improvements, also construct, as part of the improvement, docks, wharves, or terminals for freight?"

Wharves for private use are constructed at the expense of the interested parties. There are no docks within this consular district. Freight terminals are built by the government railway authorities; and if for the limited use of certain corporations, then at their expense.

3. "What is the navigable depth, at mean low water, of the leading harbors, and the range of tide in same?"

There is no tide at the ports of this district. The average depth at Swinemunde is 8 meters (26 feet 4 inches), at Stettin 7 meters (22 feet 9 inches). A continued southern wind will drive out 1 or 2 feet of water within several days, and just the reverse with a northwest wind.

4. "What is the navigable length and the channel depths and widths, at mean low water, of the principal rivers and canals?"

The principal deep waterway within Pomerania is the canal and river way between Stettin and Swinemunde, and has a length of 72 kilometers (44.73 miles). The Oder River has an average width of 80 meters (264 feet 4 inches); across the bay, an average width of 125 meters (410 feet). The "Kaiserfahrt"—that is, the canal from the bay to Swinemunde—has an average width of 150 meters (492 feet). The entrance from Baltic Sea to Swinemunde has a depth of 9 meters (29 feet 5 inches).

5. "Can you state the increase, respectively, in recent years, of freight carried by railways and inland waterways, and what is the proportion carried by each at this time?"

In answering this question, the statistics for the Empire will be of most importance.

*Railways.*—At the close of 1891 the Government and private corporations possessed 42,269 kilometers (26,643 miles) of standard-gauge railway; ten years later (1901), 51,042 kilometers (31,716 miles). As to narrow-gauge railways, statistics show at the close of 1901 1,893 kilometers (1,176 miles) belonging to the Government and corporations.

The following table, expressed in metric tons, shows the total weight of freight handled in the Empire for the year mentioned. It will be seen that the total of the year 1901 shows a decrease compared with 1900. This is explained in the fact that in 1901 the German business depression reached its limit.

*Freight carried.*

| | Total. | To seaports. | From seaports. | Between ports. |
|---|---|---|---|---|
| 1899 | 251,870,000 | 7,893,000 | 5,903,000 | 754,000 |
| 1900 | 268,907,000 | 8,274,000 | 6,236,000 | 840,000 |
| 1901 | 263,327,000 | 8,352,000 | 6,264,000 | 949,000 |

In looking over the list of the principal articles conveyed, it is noticed that coal, coke, peat fuel, iron ore, earth for manufacturing purposes, and building stones form in weight more than one-half of the freight carried. Private railways form less than one-tenth of the entire system. In May of this year the Prussian Government completed arrangements whereby it acquired the ownership of six private railways. It might be added that concessions for building private roads are only granted upon the condition that the kingdom can acquire ownership at any time, a basis for arriving at the terms and selling price being arranged for in advance.

*Waterways.*—The total length of navigable waterways within the German Empire is 14.366 kilometers (8,932 miles), and is divided as follows: Rivers, 9,291.73 kilometers (5,773 miles); canalized rivers, 2,469.35 kilometers (1,534 miles); canals, 2,473.96 kilometers (1,537 miles); North Sea Canal, 98.65 kilometers (61.3 miles); new fairway between Pillau and Königsberg, 32.5 kilometers (20.2 miles). About one-half of the total length is not navigable to vessels drawing more than 40 inches.

The following table gives the weight, in metric tons, of merchandise transported via water:

| | 1900. | 1901. |
|---|---|---|
| Upstream | 11,966.203 | 12,137.396 |
| Downstream | 9,848.638 | 9,971.557 |
| Total | 20,814.841 | 22,108.943 |

RECAPITULATION.

| | 1900. | 1901. |
|---|---|---|
| Merchandise carried via rail | 268,907.000 | 263,327.000 |
| Merchandise carried via water | 20,814.841 | 22,108.943 |
| More via railroad | 248,092.159 | 241,218.057 |

6*a*. "What are the comparative rates for the carriage of freight by railway and by inland waterways?"

Railroad freight rates depend upon distance, nature of freight, and quantity. In certain times of the year special rates on certain articles are made. This question would be best answered with a copy of the Prussian railway freight rates. As to water freight rates, they vary "with the wind." When short of cargo, or meeting competition, the ship agents will make very low rates. Contracts for a certain amount of space or a certain number of tons per year are also made at very low figures; such a thing as a general rate on inland waterways does not exist. There is no mutual understanding on this

point, particularly where there is competition. For the high seas, a general fixed rate exists to a certain degree; but then only among lines having an agreement. "Tramps" take cargo from Stettin to Baltimore or New York as low as 6/6 a ton.

6*b*. "State, if practicable, with illustration, what the influence of the improved waterway has been upon the freight charge for land carriage."

In answer to this question, I quote a translation from the report of the local chamber of commerce for the year 1902.

> First of all, is the combative competition waged by government railways against river and canal freight carriers. By and by bulk goods on through cars from place of loading to place of discharging will be favored with the lowest special rates, while transshipments via water along such routes as are covered by the railroad will be practically shut out. On the other hand, for such stretches on which the vessel must calculate with railway rates and connections for freight, the railway charges are comparatively higher, so that in many cases the participation of vessels in carrying such freight is almost shut out. By such means the principal bulk articles have been withdrawn from the Oder River. In several cases the vessels are not in position to compete, and in other cases can only enter into competition under most favorable conditions, i. e., high water, full cargo, and a freight rate almost at cost.
>
> All petitions to the Royal Government for the modification or the regulating of tariffs, so that waterway transportation can modestly compete, have been rejected. There seems to be a tendency of increasing such measures more and more until finally shipments via the Oder River will no longer be reckoned with.

In regard to the position of the Government toward the development of inland waterways for the purpose of freight and passenger trade, it might be stated that it has absolutely no income from the source, while in the case of the state railroads the gross earning for 1892 amounted to $211,344,000; for the year 1901, $289,308,000. Everything possible is being done for the development of Germany's salt-water merchant marine—a most important commercial and financial factor. The inland fleet can exist but not thrive.

7. "What is the apparent tendency as regards further development of inland waterways by canalization of rivers and the construction of canals?"

Covered in answer to question No. 6.

8. "What is the approximate amount of money expended to date in the respective countries for the improvement, maintenance, construction, and repair of rivers, harbors, and canals?"

The Prussian minister of public works instructed the local authorities not to answer the questions 8*a*, 8*b*, 8*c*, and 8*d*.

9. "Are there statistics given by public documents, or otherwise, stating the tonnage handled in or on the different ports, rivers, and canals, and the value of such tonnage?"

Part of the referred-to statistics can be had from the minister of public works at Berlin, or from the various chambers of commerce situated at ports, but they do not quote the value of tonnage handled.

10. "What is the length and depth at mean low water of each canal?"

Answered under question 5, as far as this consular district is concerned.

(*b*) "The number of locks and dams in each canal or canalized river?"

No locks or dams within this district, which also answers questions 10*c*, 10*d*, and 10*e*.

11. "What is the nature of the engineering work carried on at each particular improvement?"

The engineering work on the quay of the free harbor consists of five rows of piles from 3 to 4 feet apart. The filling between piles is of concrete and artificial stone blocks. The water side is faced with brick.

JOHN E. KEHL, *Consul.*

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STUTTGART, GERMANY.

CONSULATE OF THE UNITED STATES,
*October 10, 1903.*

Hon. FRANCIS B. LOOMIS,
*Assistant Secretary of State, Washington, D. C.*

SIR: I have the honor to report as follows regarding harbor and river improvements, pursuant to department's circular instructions of May 8, information regarding which it was not possible to procure earlier:

Of all the rivers in the Kingdom of Wurtemberg, only the lower part of the Neckar is navigable. Most of the river improvements were done in order to prevent floods.

1. The costs of river improvements are usually paid by the Government, but sometimes by the towns and communities same as other government and town charges.

(*a*) River improvements are only made on the larger rivers in Wurtemberg, viz: The Iller, Argen, and Danube, from Ulm downward, and the costs are paid by the Government; in other cases the improvements are made by corporations, but in very few instances by individuals. River improvements on the Neckar, in the interest of navigation, are made by the Government. A law is at present proposed to make river improvements on other rivers besides the above mentioned at the expense of the Government.

(*b*) In such cases where it is the duty of the Government to make river improvements, all the charges are paid by the Government; in other cases the Government pays part of the expenses, and the balance is paid by the localities or corporations.

(*c*) The usual share of the Government was formerly one-third, but it now amounts to one-half of the net costs. The Government usually pays to the municipalities one-third of the running expenses of the river improvements.

(*def*) There are no tolls charged upon traffic on the Neckar.

(*g*) The larger river improvements executed by the Government are usually carried out by contract, and only smaller works are done by hired labor.

2 and 3. There are no harbors in Wurtemberg.

4. The navigable length of the Neckar, from Lauffen to the frontier, is 36 kilometers, average width 30 meters, and average depth 0.70 meter.

5. Unable to obtain information on this point.

(*a*) The rates for the carriage of freight are different for the different classes of goods.

(*b*) Can not be ascertained.

7. The building of 600-ton ships is proposed as desirable to ply between Mannheim and Esslingen. The length of this waterway in Wurtemberg is 110 kilometers, but the prospects at present point only for the line between Mannheim and Heilbronn, a length of 24 kilometers.

8*a*. For improvements and maintenance of the lower Neckar the sum of between 37,000 marks and 82,000 marks was annually expended an average of 57,000 marks.

(*b*) Of the amount stated above about 21,000 marks were annually expended for extraordinary improvements.

(*c*) For the maintenance of canals, locks, and dams, also for the clearing of the waterway, the annual average sum of 35,000 marks was expended. The present annual costs amount to 42,000 marks.

9. In the annual report of the chamber of commerce, statistics are given regarding traffic upon the Neckar.

10. The depth of the Neckar waterway is, at mean low water, 50 centimeters, between Lauffen and the frontier. There is a lock constructed of stone; the doors are made of iron.

11. From a technical point nothing extraordinary can be stated regarding these works.

I am, sir, with great respect, your obedient servant,

EDWARD H. OZMUN, *Consul.*

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## ZITTAU, GERMANY.

### REPORT ON HARBOR AND RIVER IMPROVEMENT.

CONSULATE OF THE UNITED STATES,
*June 25, 1903.*

The circular of the Department of State dated May 8, 1903, can elicit but little information of value from this district. Small in area, it is nowhere touched by any navigable stream and only partially interested in the question of inland transportation by such means.

The most proximate improved waterway is the river Elbe, which is about 60 miles distant at its nearest point of contact, Dresden.

From the consulate there, or those at Hamburg or Magdeburg, will probably come more accurate and comprehensive reports concerning the great utility of that stream than can be expected from this remote point.

It is found that no statistics are kept in this district from which the detailed inquiries of the department circular might be satisfactorily answered, but a general investigation developed that some of the local manufacturers, during the open seasons of the year, and for certain bulky raw materials, imported from abroad and not immediately needed, make use of the barge lines on the Elbe for the distance between Hamburg and Dresden, instead of an all-rail transportation, and that, in this way, a saving is realized on the freight, amounting to from 33 to 50 per cent, the rate being somewhat variable. For articles shipped from the district this route is but rarely selected, first, because the delay incident to this means of transportation is not tolerated by most consignees, and, again, because the rates downstream

are uniformly much higher, owing to the large quantities of coal towed in that direction.

An undoubted general benefit is also shared by this community with others located within the zone of influence exerted by cheap transportation on the Elbe. Coffee, rice, American petroleum, and other staples are towed inland by the barge lines on that stream in great quantities, and the consequent influence upon prices of these articles to consumers is large, though not accurately determinable.

HUGO MUENCH,
*United States Consul.*

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### CANALS OF ALSACE-LORRAINE.

[From United States Consul Liefeld, Freiburg, Germany.]

Alsace-Lorraine has a great network of canals, of which the most important are: (1) The Rhine-Marne, extending from Marne River, in France, past the city of Nancy, France, to Strassburg, Alsace; (2) the Saar canal system, from the River Saar, at Saargemuend, in the northern part of Lorraine, southward, joining with the Rhine-Marne Canal; and (3) the Rhine-Rhone system, connecting the Rhine with the Rhone in France, and extending in Alsace from Strassburg to Mulhausen, thence westward toward Belfort, France.

One of the chief articles transported on these canals is coal, brought from Belgium and from the Saar and Ruhr districts of Germany. In the winter season the formation of ice interferes somewhat with this traffic, the closed season averaging from fifty to sixty days. Other articles transported in great quantities are limestone, sandstone, lime, chalk, sand, and porcelain earth, grain, fertilizers, petroleum, naphthalene, chemicals, iron ores, grindstones, etc.

The total traffic on these canals and the Mosel River during 1900 and 1901, and the classification, is shown in the following table:

| Classification. | 1900. | | 1901. | | Decrease in 1901. |
|---|---|---|---|---|---|
| | *Tons.* | *Per cent.* | *Tons.* | *Per cent.* | *Tons.* |
| Importation | 561,365 | 31.7 | 496,640 | 29.9 | 64,725 |
| Transportation | 422,291 | 23.9 | 398,650 | 24 | 23,641 |
| Inner traffic | 561,929 | 31.8 | 552,356 | 33.2 | 9,573 |
| Exportation | 222,860 | 12.6 | 214,382 | 12.9 | 8,478 |
| Total | 1,768,445 | 100 | 1,662,028 | 100 | 106,417 |

The general average distance of all the commodities transported on the Alsace-Lorraine system of canals during 1901 was 66.37 miles; during 1900, 65.47 miles.

E. THEOPHILUS LIEFELD,
*Consul.*

FREIBURG, GERMANY, *September 14, 1903.*

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### BUDAPEST, HUNGARY.

CONSULATE OF THE UNITED STATES,
*December 30, 1903.*

Hon. FRANCIS B. LOOMIS,
*Assistant Secretary of State, Washington, D. C.*

SIR: Agreeably to the department's circular of May 8 last, I beg to inclose herewith in duplicate (1) a report on the harbors and

rivers of Hungary and (2) a statistical table relating to the same; further, to inform you that in addition I have forwarded under separate cover direct (3) Hungary's Statistical Yearbook for 1901 (in French translation). These were all received this morning from the Royal Hungarian ministry of agriculture.

The department is respectfully requested to notify Representative Burton of their arrival.

I am, sir, your obedient servant,

FRANK DYER CHESTER,
*United States Consul.*

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ANSWERS TO THE QUESTIONS RELATING TO RIVER AND HARBOR IMPROVEMENTS.

1. (*a*, *c*) The costs for regulating the beds of navigable rivers are provided by the Government. These costs are granted by legislature for a series of years on the motion of the secretary of state for agriculture on the basis of a comprehensive plan, the costs of one year's improvements being included in the budget for that year in accordance with the general law.

The necessary costs for constructing levees to prevent inundations are borne by corporations, the members of which are the owners of the land protected by the levees, the expenses being divided among the landowners in proportion to the benefit accruing to each landowner. The Government gives to these corporations its aid and assistance in a variety of circumstances.

Harbors are built by the Government at its own expense. The state has constructed hitherto principally winter harbors.

(*b*) Between the Government and localities or individuals benefited there is no apportionment of the costs of harbor improvements.

(*d*) The port dues of the winter harbors are fixed according to the surface occupied by the floating object. The amounts so collected are hardly sufficient to cover the expenses of maintenance.

(*e*) See answer to paragraphs 1 (*a*, *c*).

(*f*) The only navigation canal in Hungary is the Francis Canal. It is owned by a joint-stock company subsidized by the state. This joint-stock company collects moderate fees on its canal, but the income barely exceeds the costs of maintenance. The profit is 0.47 per cent of the company's capital, which is $5,420,800. The navigation on the rivers under canalization is free; the state collects no fees on such rivers.

(*g*) The works executed by the Government are carried out sometimes by contract, sometimes by hired labor.

(*h*) If carried out by contract tenders are invited, the lowest generally being accepted.

2. In our only sea harbor, Fiume, the wharves or terminals for freight are constructed by the Government. There are no dry docks, only one floating dock, which is owned by a joint-stock company subsidized by the state. The wharves of river harbors and the quays of towns are constructed by the Government, while the improvements for shifting the freight from ship to car are made and maintained by the navigation companies.

3. The navigable depth at mean low water in river harbors and rivers is 2 meters, in the sea harbor at Fiume 8 meters. The differ-

ence between the highest and lowest water level is in the Danube at Budapest, 6.75 meters, in the Tisza at Szeged, 10.42 meters. The range of tide in the Fiume harbor is 0.31 meter in average.

4. The navigable length of our principal rivers and canals are given in the "Statistical Annual," page 222. The minimum depth of water in canals and canalized rivers is 2 meters.

The available length of locks in canals is 70 meters, the available width 9 meters, the depth on sills of the locks 2.5 meters.

5. Can not be answered.

6. (*a*) The rates for the carriage of freight are: By railway, $0.012; by inland waterways on rivers, $0.0016–$0.002 per ton (1,000 kilograms) and kilometer.

(*b*) Can not be answered.

7. The improvement of the principal rivers and the canalization of the smaller ones will be continued so as to secure 2 meters depth at low water on all inland waterways.

8. (*a–d*) The amounts expended by the Government from 1867 up to date for the improvement, construction, maintenance, and repair of rivers and harbors are given in the accompanying list.

9. The statistics needed are not at hand; their production requires more time; if desired, they can be sent later.

10. (*a–e*) The length of the canals of the Francis Canal Company is 238 kilometers. The cost of construction of these canals was $5,418,000; consequently the cost of 1 kilometer was $23,154. On these canals there are 12 locks, with a total fall of 34.7 meters, constructed at a cost of $1,500,000. Further data are given in the answer to paragraph 4.

Budapest, December 1, 1903.

EUGÈNE DE KVASSAY,
*Chief of the Waterworks Department of the Royal Hungarian Ministry of Agriculture.*

*Amounts expended by the Government from 1867 to 1902 for the improvement, construction, maintenance, and repair of rivers and river harbors.*

| Year. | Improvement, construction, and repair. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Duna. | Tisza.[a] | Koros. | Temes. | Maros. | Drava. | Szava. |
| | *Crowns.* | *Crowns.* | *Crowns.* | *Crowns.* | *Crowns.* | *Crowns.* | *Crowns.* |
| 1867 | 201,840 | 48,625 | ..... | ..... | ..... | ..... | ..... |
| 1868 | 534,596 | 520,948 | ..... | 57,000 | 3,910 | 106,120 | ..... |
| 1869 | 520,554 | 397,287 | ..... | ..... | 5,384 | 113,880 | ..... |
| 1870 | 169,080 | 1,886,139 | ..... | ..... | 5,997 | 120,000 | 779 |
| 1871 | 305,770 | 975,699 | 201,570 | ..... | 27,098 | 120,000 | 68,618 |
| 1872 | 3,386,922 | 1,184,525 | 165,867 | ..... | 56,089 | 120,000 | 256,227 |
| 1873 | 5,026,093 | 698,452 | 2,284 | 109,476 | 80,346 | 56,000 | 231,499 |
| 1874 | 4,432,292 | 544,599 | 261,289 | 60,120 | 6,567 | 90,285 | 57,605 |
| 1875 | 2,717,416 | 430,783 | 210,345 | 187,217 | ..... | 40,000 | 17,193 |
| 1876 | 1,507,990 | 288,763 | 91,105 | 55,212 | ..... | 21,787 | 39,684 |
| 1877 | 1,264,187 | 800,708 | 29,812 | 24,760 | ..... | 45,000 | ..... |
| 1878 | 712,278 | 1,381,139 | 52,172 | 19,980 | ..... | 40,000 | ..... |
| 1879 | 1,329,491 | 6,335,426 | 1,903 | 22,972 | ..... | 39,999 | ..... |
| 1880 | 3,113,379 | 4,129,045 | 132,485 | 9,820 | ..... | 100,000 | ..... |
| 1881 | 1,876,246 | 1,863,301 | 436,047 | 2,214 | ..... | 80,000 | 20,502 |
| 1882 | 2,801,950 | 3,977,474 | 1,187,455 | 13,128 | ..... | 100,000 | 28,045 |
| 1883 | 3,180,441 | 1,895,683 | 1,229,090 | 399 | ..... | 120,000 | ..... |
| 1884 | 3,509,031 | 1,944,265 | 416,393 | 27,331 | ..... | 274,707 | ..... |
| 1885 | 3,094,024 | 2,367,118 | 1,533,386 | 35,097 | ..... | 333,659 | 140,000 |
| 1886 | 3,266,987 | 1,426,163 | 919,846 | 54,000 | ..... | 300,000 | 149,597 |
| 1887 | 2,746,094 | 932,008 | 487,987 | 54,000 | ..... | 330,300 | 2,772 |
| 1888 | 2,479,384 | 901,872 | 386,230 | 54,000 | 60,000 | 300,000 | ..... |

[a] Includes Bodrog and Szamos.

*Amounts expended by the Government from 1867 to 1902 for the improvement, etc., of rivers and river harbors*—Continued.

| Year. | Improvement, construction, and repair. | | | | | | |
|---|---|---|---|---|---|---|---|
| | Duna. | Tisza. | Koros. | Temes. | Maros. | Drava. | Szava. |
| | *Crowns.* | *Crowns.* | *Crowns.* | *Crowns.* | *Crowns.* | *Crowns.* | *Crowns.* |
| 1889 | 2,479,520 | 999,882 | 991,794 | 53,980 | 59,923 | 390,000 | ..... |
| 1890 | 2,592,298 | 1,323,354 | 997,524 | 54,000 | 49,992 | 114,000 | ..... |
| 1891 | 2,737,272 | 991,677 | 779,906 | 39,989 | 129,975 | 133,302 | ..... |
| 1892 | 2,921,765 | 1,500,000 | 660,000 | 16,000 | 50,000 | 140,000 | 99,994 |
| 1893 | 2,901,954 | 1,655,524 | 753,889 | 53,245 | 89,111 | 149,536 | 60,534 |
| 1894 | 5,097,827 | 3,058,551 | 788,202 | 49,040 | 119,726 | 215,379 | 305,618 |
| 1895 | 3,312,237 | 2,498,370 | 453,704 | ..... | 101,947 | 189,997 | 243,654 |
| 1896 | 3,905,407 | 3,421,730 | 514,781 | 349,840 | 126,947 | 279,725 | 268,102 |
| 1897 | 4,142,743 | 3,162,513 | 474,828 | 230,524 | 66,571 | 426,053 | 84,335 |
| 1898 | 6,956,416 | 4,061,154 | 708,533 | ..... | 147,883 | 552,481 | 101,346 |
| 1899 | 4,201,020 | 2,599,939 | 557,373 | 15,280 | 203,370 | 598,983 | 34,500 |
| 1900 | 3,784,047 | 2,800,077 | 528,563 | 12,346 | 204,376 | 405,459 | 12,672 |
| 1901 | 4,928,283 | 1,933,590 | 620,850 | 95,938 | 179,538 | 604,173 | 296,533 |
| 1902 | 3,863,807 | 1,664,189 | 342,379 | 14,356 | 139,485 | 209,297 | 89,244 |
| Total | 102,000,641 | 66,600,572 | 16,917,592 | 1,771,364 | 1,914,235 | 7,170,122 | 2,609,053 |

| Year. | Improvement, construction, and repair. | | | | | | Maintenance. |
|---|---|---|---|---|---|---|---|
| | Kulpa. | Francis Canal. | Mura. | Vag. | Other rivers and miscellaneous works. | Total | |
| | *Crowns.* | *Crowns.* | *Crowns.* | *Crowns.* | *Crowns.* | *Crowns.* | *Crowns.* |
| 1867 | ..... | ..... | ..... | ..... | ..... | 250,465 | 198,007 |
| 1868 | ..... | ..... | ..... | ..... | ..... | 1,222,574 | 240,117 |
| 1869 | ..... | ..... | ..... | ..... | ..... | 1,037,105 | 183,759 |
| 1870 | ..... | ..... | ..... | ..... | 385,600 | 2,567,595 | 507,866 |
| 1871 | ..... | ..... | ..... | ..... | 402,803 | 2,101,558 | 517,398 |
| 1872 | ..... | ..... | ..... | ..... | 290,294 | 5,459,924 | 719,630 |
| 1873 | ..... | ..... | ..... | ..... | 274,097 | 6,478,247 | 668,492 |
| 1874 | ..... | ..... | ..... | ..... | 152,615 | 5,605,472 | 615,630 |
| 1875 | ..... | ..... | ..... | ..... | 124,544 | 3,727,498 | 334,189 |
| 1876 | ..... | ..... | ..... | ..... | 58,023 | 2,062,564 | 431,630 |
| 1877 | ..... | ..... | ..... | ..... | 37,691 | 2,202,158 | 363,228 |
| 1878 | ..... | ..... | ..... | ..... | 14,563 | 2,220,132 | 406,625 |
| 1879 | ..... | ..... | ..... | ..... | 75,346 | 7,805,137 | 444,193 |
| 1880 | ..... | 398,520 | ..... | ..... | 73,732 | 7,956,981 | 552,630 |
| 1881 | ..... | ..... | ..... | ..... | 61,395 | 4,339,705 | 511,896 |
| 1882 | ..... | 24,800 | ..... | ..... | 57,984 | 8,190,836 | 576,500 |
| 1883 | ..... | ..... | ..... | ..... | 130,692 | 6,556,305 | 394,212 |
| 1884 | ..... | ..... | ..... | ..... | 102,306 | 6,274,033 | 613,481 |
| 1885 | ..... | ..... | ..... | ..... | 106,681 | 7,609,965 | 606,120 |
| 1886 | ..... | ..... | ..... | ..... | 196,807 | 6,313,400 | 497,909 |
| 1887 | ..... | ..... | ..... | ..... | 131,209 | 4,684,370 | 505,446 |
| 1888 | ..... | ..... | ..... | ..... | 200,000 | 4,381,486 | 841,008 |
| 1889 | ..... | ..... | ..... | ..... | ..... | 4,885,099 | 358,835 |
| 1890 | ..... | ..... | ..... | ..... | 70,000 | 5,201,168 | 1,031,505 |
| 1891 | ..... | ..... | ..... | ..... | 49,997 | 4,862,118 | 1,092,220 |
| 1892 | ..... | ..... | ..... | ..... | ..... | 5,387,759 | 1,254,694 |
| 1893 | ..... | ..... | ..... | 20,482 | ..... | 5,684,275 | 746,069 |
| 1894 | ..... | ..... | ..... | 81,931 | ..... | 9,716,274 | 936,642 |
| 1895 | ..... | 62,868 | ..... | 33,774 | ..... | 6,896,551 | 973,429 |
| 1896 | ..... | 431,531 | ..... | 119,499 | ..... | 9,417,562 | 602,270 |
| 1897 | ..... | 843,415 | ..... | 129,443 | 129,913 | 9,690,338 | 850,831 |
| 1898 | ..... | 149,382 | ..... | 193,124 | 214,558 | 13,084,877 | 579,912 |
| 1899 | ..... | 506,099 | ..... | 82,563 | 206,805 | 9,005,932 | 586,839 |
| 1900 | ..... | 152,538 | ..... | 94,308 | 261,888 | 8,256,274 | 917,040 |
| 1901 | ..... | 1,665 | ..... | 111,582 | 652,861 | 9,425,013 | 895,660 |
| 1902 | ..... | ..... | ..... | 44,947 | 906,632 | 7,274,336 | 833,379 |
| Total | ..... | 2,570,818 | ..... | 911,653 | 5,369,036 | 207,835,086 | 22,389,291 |

## PRAGUE, BOHEMIA.

### REPORT ON HARBOR AND RIVER IMPROVEMENTS.

CONSULATE OF THE UNITED STATES,
*June 20, 1903.*

1. The costs of regulation of rivers for the purpose of navigation and defrayed jointly by the Austrian Government and the Provinces. The pro rata of contribution is fixed by a special bill or arrangement in each particular case. For instance, the cost of the canalization of the lower Moldau and Elbe courses from Prague to Aussig, amounting to 12,900,000 florins ($5,237,400), has been provided to the extent of two-thirds by the government treasury and one-third by the Kingdom of Bohemia. The construction of river ports on the Elbe and the Danube was carried out partly by the Austrian Government, partly by the local communities, and partly by the adjoining railway companies. For instance, the port of Rosawitz was built in 1857 by the Dux-Bodenbach Railway Company, the port of Aussig in 1866 by the Aussig-Teplitz Railway Company, the port of Laube in 1879 by the Austrian Northwestern Railway Company, and the port of Grosspriesen in 1887 by the Austro-Hungarian State Railway Company.

The Moldau port at Holleschowitz was constructed at the joint expense of the Austrian Government and the Kingdom of Bohemia, the pro rata of the respective contributions not being fixed yet. The winter and raft basin at Smichow, on the Moldau, was constructed by the Government.

2. (*a*) Improvements in the navigation of rivers and harbor works are undertaken by the Government or the Provinces. No private corporations nor individuals have so far taken any active part in these matters.

(*b*, *c*) Regarding the expenses incurred by regulations of river and harbor works a repartition between the State, the provinces, and the individuals who derive direct or special benefits from the said improvements is expected, in order that only such rivers can be regulated or such canals be constructed respecting which the province in question has undertaken the yearly payment of a sum sufficient to provide for the interest and for the liquidation of one-eighth of the government bonds issued to provide means to cover costs of the canalization, regulation, or improvement of the rivers, canals, or harbors.

To this end the province is entitled to call for support upon the parties interested. The mode of such participation is to be provided for by the legislation of the province. No special bill has been passed so far to this effect. For the cost of regulation of such rivers, which without being themselves intended for navigation purposes, yet form a united water system, the contributions, according to a bill of February 13, 1903, are fixed at a rate of 40 per cent by the Kingdom of Bohemia and 60 per cent by the Government. The proportions of contributions by districts, parishes, and water companies (for the lightening of the provincial expenses) must be decided in each case by legislation which are in no event to exceed 20 per cent of the final cost.

(*d*) The collection of tolls on the natural waterways of the Elbe and Danube is precluded by international treaties, but respecting the rates and taxes for the use of the proposed waterways provision is made by the above-mentioned legislation. The adjustment of such rates or tolls is fixed by the Government.

There is no relation between such tariffs or rates and the cost of the intended canals or canalization. There is, however, a connection between the amount of tolls or rates collected and the contributions by the provinces, which latter according to legislation have to be discontinued as soon as the revenue of the canal or canalization will for two consecutive years have exceeded the amount required for payment of interest and sinking fund of the capital invested in said canal or part of canal.

(*e*) A subsidy for the proposed improvements by private companies does not exist, but large cities, viz, Vienna and Prague, are called upon to contribute toward the expenses of river regulations.

(*f*) Apart from the Danube and Elbe tolls are collected on other rivers the canalization of which has been approved by the bill of 1901, which revenue goes into the government treasury, inasmuch as the financial means required for the construction of the said canals or canalizations were provided for out of the treasury or by the issuance of government bonds.

(*g*, *h*) As regards the so far completed waterway improvements, for instance the canalization of the Moldau and the Elbe from Prague to Aussig, the work has been intrusted to a private concern. The particulars of the contract are not made public.

4. The lengths of the navigable rivers of Austria are as follows:

| | Kilometers. |
|---|---|
| The Elbe from Melnik to the frontier | 109 |
| The Moldau from Budweis to Melnik | 242 |
| The Danube from Passau to Pressburg | 348 |

Lengths of the canal schemes under consideration:

| | Kilometers. |
|---|---|
| From the Danube to the Oder | 275 |
| From the Danube to the Moldau (between Vienna and Budweis) | 205 |
| From the Danube to the Moldau (between Linz and Budweis) | 95 |
| From the Danube-Oder Canal to the Elbe (between Prerau and Pardubitz) | 188 |
| From the Danube-Oder Canal to the Vistula and thence to a navigable course of the Dniester | 426 |

The proposed standard depth of canal is put down generally with 2.1 meters; it is expected that two or three standards of depth will be adopted.

5. The goods traffic over the Austrian railways during 1900 shows the following totals:

| | Tons. | Ton-kilometers. |
|---|---|---|
| Government railways | 39,771,684 | 4,640,219,584 |
| Government railways with private service | 336,897 | 2,226,442 |
| General railways (not government) | 79,072,901 | 6,507,385,522 |
| | 119,181,482 | 11,149,831,548 |

Goods traffic by water on the Elbe:

| Year. | Tons. | Ton-kilometers. |
|---|---|---|
| 1896 | 3,169,940 | 103,524,458 |
| 1897 | 3,214,616 | 103,898,339 |
| 1898 | 3,017,468 | 96,554,159 |
| 1899 | 3,415,659 | 111,976,685 |
| 1900 | 2,798,797 | 89,064,985 |
| 1901 | 3,483,119 | ..... |
| 1902 | 3,360,361 | ..... |

Owing to incomplete returns of the waterway traffic, no precise figures can be given, but a leading authority estimates that in the year 1890 the goods traffic by water was about 7 per cent, whilst the railways carried the remaining 93 per cent. Considering the great expansion of railways which has taken place since, it must be assumed that the proportion of goods forwarded by waterways will have been further reduced.

6. The fundamental bill of waterways in Austria was passed in 1901. The legislative action respecting waterways is thereby concluded.

7. For the first working period of 1904 to 1912 Parliament granted 175,000,000 crowns ($35,525,000). According to the working programme of the Government operation should be commenced by the canalization of the Moldau in the district of Prague (estimated cost about 14,000,000 crowns), the canalization of part of the Elbe from Melnik to Jaromer (estimated cost 37,000,000 crowns), the so-called "Danube-Oder" or more correctly "Ostrau Canal," and of portion of the canal communication from the Danube-Oder Canal in the direction of Klattau.

8 (*a* to *c*). Can not be answered at present.

9. Figures of tonnage by water are not to hand and no returns are made as to the value of the goods.

10. As far as it is possible at this moment to give any precise figures, the approximate cost of the various proposed works is estimated as follows:

The Danube-Oder Canal, $30,000,000 (150,000,000 crowns).

The Danube-Oder Canal, Vienna-Budweis, $28,000,000 to $33,000,000 (140,000,000 to 165,000,000 crowns).

The alternative line, Linz-Budweis, $14,000,000 to $19,000,000 (70,000,000 to 95,000,000 crowns).

The Pardubitz-Preran Canal, $26,000,000 (130,000,000 crowns).

The Galician waterways, $35,000,000 (177,000,000 crowns).

The canalization of the Moldau from Budweis to Prague, $22,400,000 (112,000,000 crowns).

The canalization of the Elbe between Melnik and Jaromer, $12,000,000 (60,000,000 crowns).

11. As regards the systems adopted, the course of the Elbe to Jaromer and the course of the Moldau from Prague to Budweis will be canalized. As regards the systems to be employed in overcoming the differences of levels, it is probable that in addition to locks also mechanical elevator constructions will be resorted to. To this end an international prize competition has been started regarding the most useful and economical systems or models.

The commission for the canalization of the rivers Moldau and Elbe in Bohemia have issued their official report for 1902 (containing further details, illustrations, and diagrams), a copy of which I have the honor to forward by same post with this.

Respectfully submitted.

ETHELBERT WATTS,
*United States Consul.*

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## PARIS, FRANCE.

### HARBOR, RIVER, AND CANAL IMPROVEMENTS IN FRANCE.

CONSULATE-GENERAL OF THE UNITED STATES,
*July 13, 1903.*

The total amount of expenditure on the enlargement and improvement of sea harbors, from the year 1814 to 1900, was $207,605,378. The principal items of this expenditure were:

| | |
|---|---|
| Le Havre | $31,962,000 |
| Dunkirk | 21,942,000 |
| Marseille | 19,364,000 |
| Calais | 11,606,000 |
| Bordeaux | 10,234,000 |

and St. Nazaire $9,000,000, Boulogne $8,250,000, Dieppe nearly $8,000,000.

The cost of all alterations and improvements is borne by Government, but it is not unusual for the department, city, local chamber of commerce, and persons interested to lend the State the whole or part of the money for important works, and also to contribute according to their means, but there is no fixed proportion. For instance, one of the improvements at Dunkirk cost $5,989,375, of which the town advanced $4,747,800. At St. Nazaire, one contract amounted to $3,570,000, of which the department of the Loire advanced $1,930,000. On another occasion, at Dunkirk, the town advanced three-fourths ($7,500,000), and at Calais the whole sum ($2,895,000) was advanced by the town. At Havre, the department contributed $193,000, and the chamber of commerce gave $772,000 and lent $675,000 toward the $6,000,000 needed.

The sums advanced bear interest till repaid (which is generally in the course of a few years), the only exception, so far as I am aware, being Havre, where a small additional port due was imposed to repay the sums advanced by the local chamber of commerce. Analyzing the total given above, I find:

| | |
|---|---|
| Paid by treasury | $149,699,024 |
| Advances (repayable by State) | 32,125,996 |
| Contributions (not repayable) | 25,780,358 |
| Total | 207,605,378 |

The average sum annually spent on the improvement of ports is 22,390,000 francs ($4,321,270), of which 3,630,000 francs ($700,590) is "contributed."

With a few trifling exceptions (about 150 miles in all) all rivers and canals are the property of the State, and circulation thereon is free. The total amount expended (1814 to 1900) was: Rivers, $127,617,777, and canals, $169,622,844. A good part of this sum was borrowed, but the State has paid back $23,683,707, between the years

1868 to 1900. The average annual expenditure is: Rivers, $2,339,505, and canals, $2,533,923; but the State derives an annual income of about $540,000 from ferries, fishing rights, towage, water supply, plantations on banks, etc.

The navigable length of the principal rivers of France is: Loire, 511 miles; Rhône, 340 miles; Seine, 286 miles; Garonne, 247 miles; Dordaogne, 245 miles; Marne, 219 miles; Saône, 201 miles; Lot, 172 miles; Moselle, 168 miles; Allier, 154 miles; and 16 others, of from 150 to 50 miles of waterway. The chief canals are: Nantes to Brest, 224 miles; Berry, 200 miles; Bourgogne, 150 miles; Marne to Rhine, 134 miles; Loire "lateral," 129 miles; Rhône to Rhine, 118 miles; Nivernais, 108 miles; and Somme, 97 miles.

Owing to the extensive network of canals in almost all parts of France goods can be conveyed almost anywhere by water, and as the canals are free the freight rates are very low. Over 9,000,000 tons of goods enter or leave Paris every year.

JOHN K. GOWDY,
*United States Consul-General.*

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## GHENT, BELGIUM.

### HARBOR AND RIVER IMPROVEMENTS.

CONSULATE OF THE UNITED STATES,
*July 11, 1903.*

In general all harbor and river improvements are made by the central government; that is to say, that the system of canals and canalized rivers is maintained as a system by the central government, but special local improvements, as wharves, docks, bridges, and terminals are sometimes made by the localities immediately and exceptionally benefited. In such instances, the cost is apportioned between the central and local governments, the central government contributing from one-half to two-thirds, depending on the nature of the improvement whether it is of special local benefit or an improvement to the general canal system.

No dues or tolls are charged upon the traffic on the canalized rivers—the Scheldt and Lys—in this consular district, but a small fraction of a cent per ton per kilometer is collected upon the traffic on the canals. The captain of the port receives all these dues and accounts for them to the "receveur des douanes et accises et contributions direct," who remits them to the minister of finances and public works at Brussels. None are paid to the city of Ghent. No portion of the dues thus collected are used specifically to pay for improvements. Generally, costs of improvements, repairs, etc., to the canal system are paid out of the general appropriation for public works made annually by the chamber. If a large and important improvement is to be made, this is provided for by a special appropriation.

All improvements are executed by the government, central or local (except as hereafter mentioned), entirely under the direction of government engineers, and not by private corporations or individuals. The government officials hire the laborers, supply the required materials, and carry through the improvement entirely independent of subletting by contract.

The only harbor in this district is at Ostend on the English Channel. Its navigable depth at mean low water is 14 feet and 30 feet at high water.

The principal ports and canals in this district are described in the following:

*Port of Ghent.*—Ghent (population, with environs, 201,211 in 1901) is located at the confluence of the Scheldt and Lys, which form the most important branches of the canal system in the two Flanders. It is connected with the North Sea by the canal of Ternuzen, at Ternuzen, a Dutch town situated on the Scheldt about 15 miles from its mouth. A network of canals and the canalized rivers, the Scheldt and Lys, connect it with the principal localities in Belgium and the northern part of France. This port comprises four basins, as shown on the plan hereto annexed and described in the following table:

| | Length. | Width. | Depth. | Area. |
|---|---|---|---|---|
| | | | *Feet.* | *Acres.* |
| Basin of commerce | 1 mile | At 1,641,196 feet<br>At 2,297,361 feet<br>At 1,313,295 feet | 18 | 321 |
| Basin of lumber | 722 feet | 380 feet | 17½ | 64 |
| Tolls basin | 1,313 feet | 394 feet | 18 | 112 |
| Avant port | 3,643 feet | 279 feet | 19 | 247 |
| | | | | 744 |

*Ternuzen Canal.*—This canal was opened to navigation on the 18th of November, 1827. As a result of the conventions concluded on the 29th of June, 1895, and the 8th of March, 1902, between Belgium and the Netherlands, improvements are now being made on this canal, which when completed will reduce it to one arm instead of two, with a total length of 20 miles. There will be two locks, one at Sas de Gand, opening of head 85 feet, distance between heads 656 feet, depth 31 feet; and the other at Ternuzen, opening of head 59 feet, distance between heads 590 feet, depth 27 feet.

The principal dimensions (in Belgium) of the improved canal will be as follows: Width at bottom, 90 feet; pitch at water line, 6/4; width at water line, 247½ feet; depth, 36 feet; width of openings of bridges, 98½ feet.

*Rights of navigation, divers taxes (canal from Ghent to Ternuzen).*—The principal taxes for seagoing vessels are shown in the following table:

| | Per Moorsom ton. |
|---|---|
| For the first 10 trips | $0.07 |
| For the next 15 trips | .06 |
| For the next 15 trips | .045 |
| For all other trips | .03 |

The count of these voyages begins on the 1st day of January each year. These taxes are doubled during the winter months.

*Ghent-Bruges Canal.*—This canal is not of much commercial importance. Its length is 27⅞ miles; depth in summer, 6½ feet; in winter, 7½ feet, and 32½ feet wide at the bottom.

*Bruges-Ostend Canal.*—Connects the city of Bruges with the port of Ostend. Its length is 13 miles; its width at the bottom varies from 45 to 65 feet; its depth in summer is 14 feet 1 inch and in winter 14 feet 7 inches. The maximum tonnage of steamers allowed in the canal is 600 tons (Moorsom).

*Port of Bruges.*—Comprises an avant port and a basin. The basin has an area of 5½ acres and is formed by the junction of the Ghent-Bruges Canal and the Bruges-Eecloo Canal. The avant port is an irregular widening of the Bruges-Ostend Canal.

*New maritime installations.*—For centuries Bruges was only connected with the sea by the Bruges-Ostend Canal. By the law of 11th of September, 1895, it was provided, first, for a port at Zeebrugge on the Belgian coast, 6¼ miles from Bruges; second, a new port at Bruges; and, third, a maritime canal connecting Bruges with Zeebrugge. (The attached plan plainly shows these improvements.)

*Maritime canal from Zeebrugge to Bruges.*—This canal connects the port of Zeebrugge with the new port of Bruges. It has a total length of 6¼ miles; its width is 72 feet at bottom, 229 feet at water line, and 262½ feet between banks. The depth is 26 feet, but this can be increased to 27½ feet. That part of the canal which connects the port of Zeebrugge with the maritime lock will have a total length of 2,461 feet, width of 163 feet at the bottom, width of 347 feet at water line, and a width of 380 feet between banks. Its depth at low tide will be 19¾ feet and about 31⅛ feet at high tide.

*The maritime lock.*—Will have a total length of 925 feet, but the distance between the gates will be only 840 feet. The clap sill at low tide will be 18 feet, thus giving a total depth of 29½ feet at high water.

*Maritime Canal.*—Extending from the maritime lock to Bruges, has a length of 6¼ miles, width at bottom 72 feet, width at water line 229 feet, and 260 feet between the banks. Its anchorage will be 26 feet deep and can be increased to $27\frac{5}{12}$ feet. This canal is without locks, having one turning bridge which can give an opening of 72 feet.

*New port of Bruges.*—The new port of Bruges will consist of three basins, the east, west, and north; the last, otherwise known as the evolution basin, will connect the two former. The east and west basins are parallel to each other, being separated by a jetty head of a total width of 394 feet. The west basin is 1,772½ feet long, 295 feet wide, and has a depth of 21½ feet. The east basin is 640 feet long, 296 feet wide, and 26 feet deep, this being the same depth as the port of Zeebrugge and the Maritime Canal. The north basin has a diameter of 525 feet. This basin empties into the Maritime Canal. In the rear of the west basin is situated the semimaritime lock, which connects the basins of the new port of Bruges with the old port and the Bruges-Ostend Canal. This lock is 39 feet wide, 564 feet long, of which 319 feet comprise the lock chamber. The depth is 15 feet 1 inch.

The approximated total cost of the construction of the port of Zeebrugge, the Maritime Canal, and the basins at Bruges will be $10,615,000, of which the Belgian Government will pay $8.106.000, the city of Bruges $723,750, the province of West Flander $386.000, and the Company of Maritime Installations of Bruges $1,399,250. It is this Company of Maritime Installations of Bruges which will complete these improvements, commenced in 1896 and which are at the present time well advanced. In consideration of its contribution to the work the Belgian Government has ceded to this company for a period of seventy-five years from the date of its completion this

entire improvement to manage and receive all taxes and revenues and appropriate the same to its own use.

*Port of Ostend.*—(Ostend population in 1901, 40,575 inhabitants.) About 130,000 foreigners visit Ostend during the year, principally in the summer months, as it is one of the most attractive watering places in Europe. It is an important port for fishing boats and the mail and passenger steamer services between Ostend and Dover and London and Tilbury, respectively. Its port comprises:

An entrance canal: Length, 1,477 feet; width, 492 feet at the widest and 328 feet at the narrowest place.

Avant-port: Length, 2,626 feet; width, 656 feet at the widest and 426 feet at the narrowest place; depth, 26½ feet at low tide.

Three wet docks: Length (lower basin), 2,133 feet; width, 295 feet; depth, lower basin, 19⅓ feet; middle basin, 15⅓ feet; other basin, 9⅔ feet.

Rear port: The canal from the "Slijkens" lock to the military lock is known as the "rear port." This latter lock may at the same time be used as a navigation lock, as it permits the entrance of the tide into rear port.

Marine basin; careening basin: On the east side of the "avant-port" are situated the marine and careening basins. These basins are used for repairing vessels belonging to the central government.

Flushing basin: This basin (known as "Bassin Leopold"), which is now being built, is destined to assure necessary depth at tides along quay.

The accompanying plan shows the relative position of these basins and docks.

The nature of the construction of canals is in general simple excavations, no masonry or walls being used to protect the sides or banks of the canals. To guard against wash occasioned by the passing of vessels their speed is reduced to about 5 miles an hour.

At the locks, wharves, and docks substantial walls of masonry are built, so that the vessels come directly alongside to load and unload. The material uniformly used for these improvements is cement, cradles of iron being imbedded in the cement at the bottom and the upper part built in with cement in the form of stone blocks.

In the statistics of Belgium, "General Table of Commerce with Foreign Countries," it is stated that the river and canal navigation in these Flanders amounted to 3,735,704 tons in 1899 and 4,364,938 tons in 1901. Statistics of the amount of freight carried by railways (alone in this district) and the amount expended in the improvement, construction, maintenance, and repair of canals are not available.

The rates for freight transportation on the Ghent-Bruges Canal and Ostend-Bruges Canal vary from 3.50 francs per 1,000 kilos to 5 francs per 1,000 kilos ($0.67 to $0.97 per ton). The rates from Ghent to Antwerp, via the canalized river Scheldt, are from 2.50 to 5 francs per 1,000 kilos ($0.48 to $0.97 per ton). Freight transportation charges by inland waterways is from 30 to 50 per cent cheaper than by rail. This is due chiefly to the cheap labor required to operate the canal boats, which are generally drawn by men, women, and children, instead of being propelled by steam or electricity or drawn by horses. These methods employed require often for transportation short distances several days, and on this account, though transportation by canals is available in most every direction, most of the freight continues to be carried by rail.

FRANK R. MOWRER, *Consul.*

GHENT, BELGIUM, *July 10, 1903.*

## BRUSSELS, BELGIUM.

### HARBOR AND RIVER IMPROVEMENTS.

CONSULATE OF THE UNITED STATES,
*September 2, 1903.*

In compliance with department circular dated May 8, 1903, I have the honor to transmit herewith all information possible to secure relative to harbor and river improvements in this consular district.

I may state that, owing to the work commenced in 1896 and still going on of transforming the port of Brussels into a seaport, I was enabled to obtain somewhat detailed information, which I attach herewith, as to the work now in progress. Cost of harbor and river improvements in Belgium is provided by the Government, which owns and controls all the navigable rivers and canals in this consular district, excepting the Lourain and Brussels Canal. Cost of improvement and repairs of ports is provided by the cities, as, per example, Antwerp, Ghent, Ostende, and Brussels, which build and work the docks and quays.

There is no apportionment of cost between the Government and localities or individuals exceptionally or immediately benefited.

Expenses are paid by port dues. The cities levy wharf dues, which are approved by royal decree.

*Tolls.*

Tolls charged upon traffic upon canals or canalized rivers are paid into the treasury without any special designation.

All works when executed by the Government are carried out by contract, and contracts are awarded to lowest bidder.

As will be seen in my report on the "Port of Brussels," herewith annexed, the Government is a subscriber in the anonymous society to the extent of 10,000,000 francs ($1,930,000).

As before stated, improvements in rivers and canals are made at the expense of the Government, but in the case of the Brussels Canal an exception was made and a special agreement entered into by which the anonymous society was incorporated with a capital divided into shares of not less value than 50,000 francs ($9,650) per share. The stock capital amounts to 33,580,000 francs ($6,480,940), divided among the following shareholders:

| | Francs. | |
|---|---|---|
| Government | 10,000,000= | $1,930,000 |
| Province of Brabant | 4,000,000= | 772,000 |
| City of Brussels | 14,000,000= | 2,702,000 |
| Commune of— | | |
| Molenbeek | 1,233,000= | 237,969 |
| Schearbeek | 837,000= | 161,541 |
| St. Gilles | 666,000= | 128,538 |
| Anderlecht | 600,000= | 115,800 |
| St. Josse Ten Noode | 504,000= | 97,272 |
| Ixelles | 455,000= | 87,815 |
| Koekelberg | 135,000= | 26,055 |
| Vilvorde | 100,000= | 19,300 |
| Etterbeek | 50,000= | 9,650 |

Tendencies are to create deep interior ports near the seacoast and give to the canals a minimum navigable depth of 3 meters (9.84 feet).

## PORT OF BRUSSELS.

Brussels, the capital of Belgium and seat of government, is 44 kilometers (27 miles) from the port of Antwerp.

### *Population.*

The total population, including suburbs, was, December 31, 1901, 562,895 inhabitants. Important manufacturing is carried on in several of the suburbs. The city is connected by rail and canal with the rich industrial districts of Mons, Charleroi, and Liege.

### *Port of Brussels.*

The port of Brussels is connected with the North Sea by canal from Brussels to Rupel (Willebroeck Canal), Rupel and the Maritime Escaut.

*Dimension of canal.*

| | Meters. | | Feet. |
|---|---|---|---|
| Length of canal | 28,034 | = | 91,951 |
| Depth of canal | 3.20 | = | 10.49 |
| Width at bottom | 15 | = | 49.20 |
| Width of water line | 33 | = | 108.24 |

The fall is controlled by five locks.

### *Docks.*

The port of Brussels now has five docks designated as follows: Traders' dock, Warehouse dock, Barge dock, Commerce dock, and Garbage dock, the total extent of which covers an area of about 45,000 square meters (147,600 square feet), with a length of quays reaching 2,650 meters (8,692 feet). Within a few years landing stages have been built along the canal between Brussels and Laeken (one of the suburbs), to meet the requirements of traffic. The railway also runs along these landing stages.

### *New maritime installations.*

Plans for widening and deepening the canal were approved by a law, dated September 11, 1895, since when important modifications have been made in these projects, notably by the laws of August 19, 1897, and May 24, 1902.

An incorporated joint stock company whose shareholders are the State, Province of Brabant, city of Brussels, its suburbs, and the town of Vilvorde, was formed June 13, 1896, for a period of ninety years.

The object of the society is, (1) purchase of present canal and its dependencies; (2) transformation of canal into a maritime canal; (3) construction of a maritime port with all necessary appurtenances—dry docks, bonded warehouses, docks, wharfs, warehouses, elevators, sheds, cranes, etc.; (4) to work the canal, port, and dependencies; (5) to work the present docks, property of the city of Brussels.

The society now controls the canal and docks as well as the bonded warehouses, warehouses, and other buildings connected therewith. The society has also contracted for the work connected with transforming the canal and construction of the seaport.

*Transformation of the canal.*

The canal after transformation must be accessible, not only for inland navigation, but also for coasting traffic, and with this object in view the depth will be temporarily increased to 5 meters 50 centimeters (18.04 feet), and definitely to 6 meters 50 centimeters (21.32 feet), with a minimum width at bottom of 18 meters (58.84 feet), and at water line a width varying from 40 meters (131.20 feet) in the narrowest sections to 60 meters (196.80 feet) in normal sections, and 70 meters (229.60 feet) to 100 meters in the moorings. The slopes will have a general declivity of 12/4.

The banks will be fortified by facings of masonry. In populated districts the masonry facings will be replaced by quays, along which the mooring depth will be 3 meters 20 centimeters (10.49 feet).

*Locks.*

There will be four locks, 114 meters 10 centimeters long (374.24 feet), 16 meters (52.48 feet) wide, and 6 meters 50 centimeters (21.32 feet) deep at the clap sills. Drawbridges will have a manipulating passage of 18 meters (58.84 feet) minimum opening and 6 meters 50 centimeters (21.32 feet) depth.

*New port.*

The new port will comprise a seaport and outer port; the latter will be reserved for large vessels engaged in coasting and transit traffic. The dock at the inner port will be 900 meters (2,952 feet) long, 120 meters (393.60 feet) wide, with a fixed depth of 6 meters 50 centimeters (21.32 feet), and area extending over 11½ hectares (28.45 acres). The wharves, which will be about 1,700 meters (5,576 feet) long, will be bordered by a plank roadway varying in width from 53 meters (173.84 feet) to 75 meters (246 feet). Cranes and sheds will be erected on the plank extension for the use of the railway.

A freight depot covering more than 30 hectares (74.22 acres) will be built near this dock, and adjacent to the depot a new public bonded warehouse will be erected.

The seaport will be connected with the Charleroi Canal by a dock for river boats having a length of 700 meters (2,296 feet), and average width of 42 meters 50 centimeters (139.40 feet), and will connect with the sea dock by a passage 12 meters (39.30 feet) wide, covered by a stationary bridge extending over 36 meters (118.08 feet) of its length. A second dock for river boats 600 meters (1,968 feet) long will be built along the Allée Verte in the ditch of the present canal.

*Outer port.*

The outer port will have a fixed depth of 6 meters 50 centimeters (21.32 feet) and 110 meters (360.80 feet) width, and 2,000 meters (6,560 feet) of quays on the right bank accessible to steam vessels. The quays will be equipped with all appliances employed in modern ports, and will have an extension of level roadway 110 meters (360.80 feet) wide connecting with the railway depot at Schaerbeek Point,

from whence trains are started. The port and its dependencies are lighted by gas. The police patrol is performed by the harbor master and police under his supervision.

*Navigation fees and other taxes—Regulations, tariffs.*

On the Rupel Canal no navigation fee is demanded; on the canal from Brussels to Rupel the fees are fixed by royal decree dated December 30, 1871.

All boats and barges navigating on the Brussels-Rupel Canal pay navigation dues based on the tonnage importance and nature of cargo. The ton is calculated as a cubic meter (35.313 cubic feet) or 1,000 kilograms (2,200 w) for all boats and barges without distinction.

Boats and barges are divided into three classes according to cargo. First class includes boats loaded with building material and merchandise other than that designated below. Second class includes boats loaded with coal, bricks, briquettes, tiles, paving and other, firewood, marl, ashes, paving stones, rough stones, hay, straw, broken glass, bones, sea water, manure, fertilizers, earth, sand, stones (for building embankments), salt of soda, crude and refined salt, rails and clamps, pig iron, old cast iron and junk, bark, rags, and old ropes. Third class includes empty boats. The navigation due is determined by ton and reaches as follows:

| | |
|---|---|
| First class | 6 centimes=$0.011 |
| Second class | 4½ centimes=$0.008 |
| Third class | 2 centimes=$0.003 |

Steam and sail boats plying regularly between Brussels and any foreign port and exporting goods benefit by a reduction of 50 per cent navigation dues. The same reduction is granted on return of same boats bringing goods from abroad for the interior or in transit. Each boat service sailing at least once a month at a fixed date known to the public is considered as regular. Ten centimes ($0.019) is collected for each receipt. The fee is collected in proportion to the real cargo of the boats, and fixed as follows:

For boats loaded with goods coming under several categories the fee is charged at the loading rate of each category. Boats and barges measuring less than 10 tons pay the same due as if carrying a full cargo of this capacity. When boats or ships have not a full cargo or when the cargo includes goods belonging to several categories the captains, bosses, or their deputies must make a declaration in writing stating quantity of tons of goods of each category, and if required attest same. In default of this formality fees are collected on the totality of tonnage, and at the rate of the highest taxes category if the cargo consists of goods belonging to several categories.

*Cargoes considered as complete.*

(1) When the sea gauge of the boat indicates a full cargo, no matter what may be the volume of goods carried; (2) when the capacity of the boat is full, or when there is an additional cargo on deck, no matter what the weight of the goods may be.

For deductions the empty part is calculated by quarter of a cargo, so that each fraction less than a quarter is not deducted.

For mixed cargoes parts of cargoes less than the quarter are not taxed at the rate of tariff of their category, but are estimated as of belonging to the category immediately preceding the goods comprising the cargo.

Boats or barges going to any point of a reach pay the tax for the whole reach, even though not passing through any lock. This regulation is not applicable to empty boats which maneuver at the entrance of the canal while waiting to sail.

*Traction and towing fees.*

The traction is exclusively by steam tugs, for which service the Anonymous Canal Company now owns 16 tugs. The tariffs regulating traction fees are shown in the three annexed tables. According to the tariffs boats are divided into two classes, according to whether they are loaded or empty. Empty boats pay only 70 to 80 per cent traction fees imposed on loaded boats mentioned in the two first tables.

The third table includes special tariff for boats carrying garbage and freight. Boats gauging less than 150 tons and belonging to the street-cleaning service of Brussels pay a tax somewhat less than other empty boats varying in tonnage from 101 to 150 tons. Seagoing vessels having a maximum draft of 3 meters 10 centimeters (10.16 feet) pay 33 francs ($6.36) for the whole distance, or 7 francs 70 centimes ($1.48) per reach, towing included.

Rates depend on two principal factors—tonnage and distance covered. The tonnage is divided into parts of 50 tons; distance is calculated from principal points of loading and unloading.

*Dock dues.*

Goods are not allowed to remain on the wharves of the docks without previous authorization. Merchandise unloaded from vessels and subject to custom-house operation is not allowed to remain on the quays, but is placed alongside the bonded warehouse and must be removed within five days after verification.

Wood for building purposes is removed the day following verification at the rate of at least 25 cubic meters (882.82 cubic feet) per day. There is no special loading or unloading tax demanded, but a tax of 0.10 centimes ($0.0019) is levied per day and per square meter (3.28 square feet) on all merchandise remaining on the dock over night. If goods are unloaded and left without authorization the tax is doubled without prejudice to other penalties.

Licensed merchants residing at Brussels may rent, at the rate of 0.50 centime ($0.096) per month and per surface meter (3.28 feet), a part of the wharf which may be decided as necessary to their business. Merchants residing outside of Brussels pay 0.75 centime ($0.144) per month and per square meter (3.28 square feet).

The subscription is reduced to 25 and 40 centimes ($0.047 and $0.077) per square meter (3.28 square feet) for space taken within the dockyards. It is prohibited to sell or sublet to a third party the part of wharf rented by any person. A receipt tax of 0.05 centime ($0.01) is levied in addition to the price of stamp exacted on receipts

of this character. A leasing price of 2 francs ($0.386) per day is charged for each bridge used.

*Crane tariff.*

Cranes belonging to the public warehouse are at the disposal of the public under conditions fixed by the Anonymous Canal Company and Maritime Installation of Brussels, and under the supervision of their agents. The tariff for using the big crane, power of which is 10,000 kilograms (22,000 pounds), is 2 francs ($0.386) per hour. Tariff for small crane, power 1,500 kilograms (3,350 pounds), is 1 franc ($0.193) per hour. No reduction is made for fractional part of hour. Every hour commenced is paid in full.

*Warehouse dues.*

Storing dues for goods in the public warehouse vary according to the nature of the merchandise. Goods deposited under the sheds of the public warehouse paying a storing due of 0.20 franc ($0.0386) for the first three days and per square meter (3.28 square feet), fractional part of space not allowed. The dues are not collected until cargo is completely discharged. Brokers, consignees, or owners of vessels can avoid the tax for storing under warehouse sheds by paying before the discharge of cargo a fee of 0.05 franc ($0.01) per ton of 1,000 kilograms (2,200 pounds) burden of the vessel when the cargo is more than half complete, and 2 centimes ($——) when the cargo is less than half the capacity of the vessel.

*Principal articles of importation.*

English beers, northern wood, wood for cabinet purposes, preserves, rags, chemical products, fresh fruits (lemons and oranges), dried fruits, clothing, vegetable oils, fats, various metals, raw hides, rosin, bitumen, and oilcloth.

*Principal articles of exportation.*

Wood (manufactured), glue, clothing, vegetable oils, fats, minerals (raw), mercery, and hardware, various metals, paper, stone, dyes and colors, plate and window glass.

*Inland navigation.*

The following table shows the importance of inland navigation in connection with the port traffic:

ARRIVALS.

| Year. | Number of loaded boats. | Tonnage. | Number of empty boats. | Tonnage. |
|---|---|---|---|---|
| 1899 | 8,435 | 899,144 | 924 | 78,718 |
| 1900 | 7,514 | 942,892 | 883 | 65,926 |
| 1901 | 6,633 | 863,339 | 954 | 97,295 |
| 1902 | 8,306 | 938,609 | 817 | 71,623 |

DEPARTURES.

| | | | | |
|---|---|---|---|---|
| 1899 | 5,430 | 466,317 | 4,062 | 524,903 |
| 1900 | 4,928 | 443,009 | 4,465 | 619,254 |
| 1901 | 4,144 | 457,005 | 1,371 | 494,403 |
| 1902 | 4,662 | 416,284 | 4,369 | 565,347 |

*Regular lines of river steamboats.*

There are two lines of river steamboats, indications concerning which are set forth in the following table:

| Name of line. | Name of vessel. | Tonnage. | Port of destination. | Departures from Brussels. |
|---|---|---|---|---|
| Van Swieten Line | Antwerpen | 133 | Amsterdam | Weekly. |
| Do | Rotterdam | 134 | do | Do. |
| H. Braakman Line | Maas | 198 | Rotterdam | Do. |

*Regular seagoing lines.*

The port of Brussels is connected with the port of London by the "City Line" of steamers. The two ships of this line the "City of London" and "City of Brussels" gauging, respectively, 215.03 and 194.93 tons, make regular weekly trips.

GEO. W. ROOSEVELT,
*Consul.*

*Merchandise imported and exported through the port of Brussels during the years 1901 and 1902.*

IMPORTS.

| Year. | By sea. | By canals and river. | Total. | Total value. | |
|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* | *Francs.* | |
| 1901 | 14,465 | 68,407 | 82,872 | 15,783,999 | $3,046,311.81 |
| 1902 | 13,639 | 154,039 | 167,678 | 20,129,201 | 3,884,935.79 |
| Increase | | 85,632 | 84,806 | 4,345,202 | 838,623.98 |
| Decrease | 826 | | | | |

EXPORTS.

| | | | | | |
|---|---|---|---|---|---|
| 1901 | 19,671 | 41,482 | 61,153 | 21,048,975 | 4,062,452.17 |
| 1902 | 22,833 | 69,513 | 92,346 | 19,740,044 | 3,089,828.49 |
| Increase | 3,162 | 28,031 | 31,193 | | |
| Decrease | | | | 1,308,931 | 252,623.68 |

*Tariff for towing.*

ASCENDING.

| From Petit Willebroeck to— | Boats from the interior, loaded. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 to 20 tons. | | 21 to 50 tons. | | 51 to 100 tons. | | 101 to 150 tons. | | 151 to 200 tons. | | 201 to 250 tons. | |
| Grand Willebroeck— | *Frs.* | | *Frs.* | | *Frs.* | | *Frs.* | | *Frs.* | | *Frs.* | |
| Downward | 1.10 | $0.21 | 1.70 | $0.33 | 2.50 | $0.48 | 4.00 | $0.77 | 5.00 | $0.96 | 6.00 | $1.16 |
| Upward (Towing included.) | 2.20 | .42 | 3.30 | .64 | 4.40 | .85 | 6.00 | 1.16 | 7.50 | 1.45 | 8.00 | 1.54 |
| Thisselt | 2.80 | .53 | 3.90 | .75 | 5.50 | 1.06 | 8.00 | 1.54 | 9.00 | 1.73 | 10.00 | 1.93 |
| Capelle-au-Bois | 3.10 | .60 | 4.40 | .85 | 6.60 | 1.27 | 10.00 | 1.93 | 11.00 | 2.12 | 12.00 | 2.31 |
| Humbeek | 3.30 | .64 | 5.00 | .96 | 7.70 | 1.49 | 12.00 | 2.31 | 14.00 | 2.70 | 15.00 | 2.89 |
| Pont-Brûlé | 4.00 | .77 | 6.60 | 1.27 | 9.40 | 1.81 | 14.00 | 2.70 | 15.00 | 2.89 | 16.00 | 3.09 |
| Tais-Fontains | 4.40 | .85 | 8.30 | 1.60 | 14.00 | 2.70 | 16.00 | 3.09 | 17.00 | 3.28 | 19.00 | 3.67 |
| Buda | 5.00 | .96 | 9.00 | 1.73 | 15.00 | 2.89 | 17.00 | 3.28 | 19.00 | 3.67 | 21.00 | 4.05 |
| Trais Trons | 5.00 | .96 | 9.00 | 1.73 | 15.00 | 2.89 | 17.00 | 3.28 | 19.00 | 3.67 | 21.00 | 4.05 |
| Amour | 5.00 | .96 | 9.00 | 1.73 | 15.00 | 2.89 | 17.00 | 3.28 | 19.00 | 3.67 | 21.00 | 4.05 |
| Pont de Laeken | 5.00 | .96 | 9.00 | 1.73 | 15.00 | 2.89 | 17.00 | 3.28 | 19.00 | 3.67 | 21.00 | 4.05 |
| Brussels (Add 10 per cent for towing.) | 5.00 | .96 | 9.00 | 1.73 | 15.00 | 2.89 | 17.00 | 3.28 | 19.00 | 3.67 | 21.00 | 4.05 |
| Five reaches | 5.00 | .96 | 9.00 | 1.73 | 15.00 | 2.89 | 17.00 | 3.28 | 19.00 | 3.67 | 21.00 | 4.05 |
| Towing, 10 per cent | .50 | .10 | .90 | .17 | 1.50 | .29 | 1.70 | .33 | 1.90 | .36 | 2.10 | .40 |
| Total | 5.50 | 1.06 | 9.90 | 1.90 | 16.50 | 3.18 | 18.70 | 3.61 | 20.90 | 4.03 | 23.10 | 4.45 |

| From Petit Willebroeck to— | Boats from the interior, loaded. | | | | | | | | | | Buckets from Charleroi. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 251 to 300 tons. | | 301 to 350 tons. | | 351 to 400 tons. | | 401 to 450 tons. | | 451 to 500 tons. | | Full, 67 to 70 tons. | |
| Grand Willebroeck: | *Frs.* | | *Frs.* | | *Frs.* | | *Frs.* | | *Frs.* | | *Frs.* | |
| Downward | 6.50 | $1.25 | 7.00 | $1.35 | 7.50 | $1.45 | 8.00 | $1.54 | 9.00 | $1.73 | 2.25 | $0.43 |
| Upward (Towing included.) | 9.00 | 1.73 | 10.00 | 1.93 | 11.00 | 2.12 | 12.00 | 2.31 | 13.00 | 2.51 | 3.00 | .58 |
| Thisselt | 11.00 | 2.12 | 12.00 | 2.31 | 13.00 | 2.51 | 14.00 | 2.70 | 15.00 | 2.89 | 4.25 | .82 |
| Capelle-au-Bois | 13.00 | 2.51 | 14.00 | 2.70 | 15.00 | 2.89 | 16.00 | 3.09 | 18.00 | 3.47 | 5.75 | 1.11 |
| Humbeek | 16.00 | 3.09 | 18.00 | 3.47 | 20.00 | 3.86 | 21.00 | 4.05 | 23.00 | 4.44 | 6.75 | 1.30 |
| Pont-Brûlé | 18.00 | 3.47 | 20.00 | 3.86 | 22.00 | 4.25 | 23.00 | 4.44 | 25.00 | 4.82 | 8.75 | 1.69 |
| Tais-Fontains | 20.00 | 3.86 | 22.00 | 4.25 | 24.00 | 4.63 | 25.00 | 4.82 | 27.00 | 5.21 | 9.75 | 1.88 |
| Buda | 23.00 | 4.44 | 25.00 | 4.82 | 27.00 | 5.21 | 29.00 | 5.60 | 31.00 | 5.98 | 10.25 | 1.98 |
| Trais Trons | 23.00 | 4.44 | 25.00 | 4.82 | 27.00 | 5.21 | 29.00 | 5.60 | 31.00 | 5.98 | 10.25 | 1.98 |
| Amour | 23.00 | 4.44 | 25.00 | 4.82 | 27.00 | 5.21 | 29.00 | 5.60 | 31.00 | 5.98 | 10.25 | 1.98 |
| Pont de Laeken | 23.00 | 4.44 | 25.00 | 4.82 | 27.00 | 5.21 | 29.00 | 5.60 | 31.00 | 5.98 | 10.25 | 1.98 |
| Brussels (Add 10 per cent for towing.) | 23.00 | 4.44 | 25.00 | 4.82 | 27.00 | 5.21 | 29.00 | 5.60 | 31.00 | 5.98 | 10.25 | 1.98 |
| Five reaches | 23.00 | 4.44 | 25.00 | 4.82 | 27.00 | 5.21 | 29.00 | 5.60 | 31.00 | 5.98 | 10.25 | 1.98 |
| Towing, 10 per cent | 2.30 | .44 | 2.50 | .48 | 2.70 | .52 | 2.90 | .56 | 3.10 | .59 | 1.03 | .19 |
| Total | 25.30 | 4.88 | 27.50 | 5.30 | 29.70 | 5.73 | 31.90 | 6.16 | 34.10 | 6.57 | 11.28 | 2.17 |

*Tariff for towing*—Continued.

DESCENDING.

| From Brussels to— | Boats from the interior, loaded. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 to 20 tons. | | 21 to 50 tons. | | 51 to 100 tons. | | 101 to 150 tons. | | 151 to 200 tons. | | 201 to 250 tons. | |
| | *Frs.* | | *Frs.* | | *Frs.* | | *Frs.* | | *Frs.* | | *Frs.* | |
| Pont de Lacken | 0.90 | $0.17 | 1.10 | $0.21 | 1.80 | $0.35 | 2.20 | $0.48 | 2.50 | $0.48 | 2.80 | $0.54 |
| Amour | 1.10 | .21 | 1.40 | .27 | 3.30 | .64 | 3.50 | .67 | 4.00 | .77 | 4.50 | .87 |
| Trois-Trons | 1.40 | .27 | 2.00 | .39 | 4.00 | .77 | 4.50 | .87 | 5.00 | .96 | 5.50 | 1.06 |
| Buda (Towing included.) | 2.00 | .39 | 2.50 | .48 | 5.50 | 1.06 | 6.00 | 1.16 | 6.50 | 1.25 | 7.00 | 1.35 |
| Trois-Fontaines | 2.50 | .48 | 3.50 | .67 | 6.50 | 1.25 | 7.00 | 1.35 | 8.00 | 1.54 | 9.00 | 1.73 |
| Pont-Brule | 3.00 | .58 | 4.50 | .87 | 8.50 | 1.64 | 9.00 | 1.73 | 11.00 | 2.12 | 12.00 | 2.31 |
| Humbeek | 3.30 | .64 | 5.00 | .96 | 9.00 | 1.73 | 10.00 | 1.93 | 12.00 | 2.31 | 14.00 | 2.70 |
| Capelle-au-Bois | 3.60 | .69 | 6.00 | 1.16 | 11.00 | 2.12 | 12.00 | 2.31 | 14.00 | 2.70 | 15.00 | 2.89 |
| Thisselt | 3.80 | .73 | 7.00 | 1.35 | 12.00 | 2.31 | 13.00 | 2.51 | 15.00 | 2.84 | 17.00 | 3.28 |
| Grand-Willebroeck | 4.40 | .85 | 8.50 | 1.64 | 14.00 | 2.70 | 15.00 | 2.89 | 17.00 | 3.28 | 19.00 | 3.67 |
| Petit-Willebroeck (Add 10 per cent for towing.) | 5.00 | .96 | 9.00 | 1.73 | 15.00 | 2.89 | 17.00 | 3.28 | 19.00 | 3.67 | 21.00 | 4.05 |
| Five reaches | 5.00 | .96 | 9.00 | 1.73 | 15.00 | 2.89 | 17.00 | 3.28 | 19.00 | 3.67 | 21.00 | 4.05 |
| Towing, 10 per cent | .50 | .10 | .90 | .17 | 1.50 | .29 | 1.70 | .33 | 1.90 | .36 | 2.10 | .40 |
| Total | 5.50 | 1.06 | 9.90 | 1.90 | 16.50 | 3.18 | 18.70 | 3.61 | 20.90 | 4.03 | 23.10 | 4.45 |

| From Brussels to— | Boats from the interior, loaded. | | | | | | | | | | Buckets from Charleroi. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 251 to 300 tons. | | 301 to 350 tons. | | 351 to 400 tons. | | 401 to 450 tons. | | 451 to 500 tons. | | Full 67 to 70 tons. | |
| | *Frs.* | | *Frs.* | | *Frs.* | | *Frs.* | | *Frs.* | | *Frs.* | |
| Pont de Lacken | 3.10 | $0.60 | 3.40 | $0.66 | 3.80 | $0.73 | 4.10 | $0.79 | 4.40 | $0.85 | 1.25 | $0.24 |
| Amour | 5.00 | .96 | 5.50 | 1.06 | 6.00 | 1.16 | 6.50 | 1.25 | 7.00 | 1.35 | 1.80 | .35 |
| Trois-Trons | 6.00 | 1.16 | 6.50 | 1.25 | 7.00 | 1.35 | 7.50 | 1.45 | 8.00 | 1.54 | 2.50 | .48 |
| Buda (Towing included.) | 7.50 | 1.45 | 8.00 | 1.54 | 8.50 | 1.64 | 9.00 | 1.73 | 10.00 | 1.93 | 3.01 | .58 |
| Trois-Fontaines | 10.00 | 1.93 | 11.00 | 2.12 | 12.00 | 2.31 | 13.00 | 2.51 | 14.00 | 2.70 | 3.75 | .72 |
| Pont-Brule | 13.00 | 2.51 | 14.00 | 2.70 | 15.00 | 2.89 | 16.00 | 3.09 | 17.00 | 3.28 | 5.00 | .96 |
| Humbeek | 15.00 | 2.89 | 16.00 | 3.09 | 17.00 | 3.28 | 18.00 | 3.47 | 19.00 | 3.67 | 6.25 | 1.21 |
| Capelle-au-Bois | 16.00 | 3.09 | 17.00 | 3.28 | 18.00 | 3.47 | 20.00 | 3.86 | 21.00 | 4.05 | 6.75 | 1.30 |
| Thisselt | 18.00 | 3.47 | 20.00 | 3.86 | 22.00 | 4.25 | 24.00 | 4.63 | 25.00 | 4.82 | 7.50 | 1.45 |
| Grand-Willebroeck | 20.00 | 3.86 | 22.00 | 4.25 | 26.00 | 4.63 | 26.00 | 5.02 | 27.00 | 5.21 | 8.75 | 1.69 |
| Petit-Willebroeck (Add 10 per cent for towing.) | 23.00 | 4.44 | 25.00 | 4.82 | 27.00 | 5.21 | 29.00 | 5.60 | 31.00 | 5.98 | 10.25 | ..... |
| Five reaches | 23.00 | 4.44 | 25.00 | 4.82 | 27.00 | 5.21 | 29.00 | 5.60 | 31.00 | 5.98 | 10.25 | 1.98 |
| Towing, 10 per cent | 2.30 | .44 | 2.50 | .48 | 2.70 | .52 | 2.90 | .56 | 3.10 | .60 | 1.03 | .20 |
| Total | 25.30 | 4.88 | 27.50 | 5.30 | 29.70 | 5.73 | 31.90 | 6.16 | 34.10 | 6.58 | 11.28 | 2.18 |

*Tariff for towing boats carrying garbage.*

[Boats loaded have a reduction of 7 per cent on tariff for ordinary boats descending. Unloaded boats come under the ordinary tariff.]

| Tonnage. | Charge. | | For towing. | | Total. | |
|---|---|---|---|---|---|---|
| | *Francs.* | | *Francs.* | | *Francs.* | |
| 1 to 100 tons | 13.00 | $2.51 | 1.30 | $0.25 | 14.30 | $2.76 |
| 101 to 150 tons | 14.00 | 2.70 | 1.40 | .27 | 15.40 | 2.97 |
| 151 to 200 tons | 16.00 | 3.09 | 1.60 | .31 | 17.60 | 3.40 |
| 201 to 250 tons | 18.00 | 3.47 | 1.80 | .35 | 19.80 | 3.82 |
| 251 to 300 tons | 20.00 | 3.86 | 2.00 | .39 | 22.00 | 4.25 |
| 301 to 350 tons | 22.00 | 4.25 | 2.20 | .42 | 24.20 | 4.67 |
| 351 to 400 tons | 24.00 | 4.63 | 2.40 | .46 | 26.40 | 5.09 |
| 401 to 450 tons | 26.00 | 5.02 | 2.60 | .50 | 28.60 | 5.52 |
| 451 to 500 tons | 28.00 | 5.40 | 2.80 | .54 | 30.80 | 5.94 |

*Maritime movement of the port of Brussels during the years 1899, 1900, 1901, and 1902.*

| Year. | Arrivals. | | | | | | Departures. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sailing vessels. | | Steamers. | | Total. | | Sailing vessels. | | Steamers. | | Total. | |
| | Number. | Tonnage. | Number. | Tonnage. | Number. | Tonnage. | Number. | Tonnage. | Number. | Tonnage. | Number. | Tonnage. |
| 1899 | 13 | 1,014 | 167 | 33,358 | 180 | 34,372 | 14 | 1,093 | 166 | 33,177 | 180 | 34,270 |
| 1900 | 11 | 846 | 153 | 30,210 | 164 | 31,056 | 12 | 912 | 152 | 30,145 | 164 | 31,057 |
| 1901 | 30 | 2,229 | 106 | 21,575 | 136 | 23,804 | 29 | 2,163 | 107 | 21,789 | 136 | 23,952 |
| 1902 | 18 | 1,377 | 104 | 21,203 | 122 | 22,580 | 19 | 1,444 | 103 | 21,007 | 122 | 22,451 |

## Supplementary Report.

### HARBOR AND RIVER IMPROVEMENTS IN BELGIUM.

I have the honor to transmit herewith a supplementary report to my report on "Harbor and River Improvements in Belgium," dated September 2, 1903, and letter and translated copy of same received from Mr. J. P. Troost, inspector-general of bridges and highways, department of finances and public works at Brussels, in reply to my communication to him dated June 4, 1903, concerning the subject-matter of this report, as well as two volumes, I and II, entitled "Voies Navigables de la Belgique" (Navigable Waterways of Belgium), and copy of map showing the dimensions of locks and depths of navigable rivers in Belgium.

Funds for river improvements are provided by the Government, and for harbor improvements the expenses are equally shared by the Government and communes. Improvements are never made by private corporations or individuals, but, according to circumstances, are undertaken either by the Government or by the municipal administration.

*Apportionment of cost.*

Harbor expenses are divided between the Government and the localities interested. Generally the localities support the expenses of building interior docks and equipment of wharves.

There is no apportionment of cost; the division of expenses is controlled by the nature of the work executed.

*Appropriation of tonnage and port dues.*

Wharf and dock dues levied for the State are incorporated in the budget of ways and means as ordinary receipts, and are not intended to be employed to liquidate the original capital appropriated for building or improving harbors.

*Local improvements.*

When improvements are promoted locally the extent participated in by municipalities is regulated entirely by the condition of the case. Participation by private corporations or individuals is not allowed.

*Traffic tolls.*

Tolls are charged upon traffic upon canals and canalized rivers, and are paid into the treasury.

*Contracts.*

Contracts are let by public bid or by private agreement, according to the importance or urgency of the work to be executed. The Government is authorized by law to contract by private agreement for any expenditure not exceeding 10,000 francs ($1,930), especially in cases where the exigency, by reason of unexpected circumstances, can not wait the delay of a public bid.

*Improvements.*

As a general rule the Government does not interfere in the building of, nor construct as part of improvements, docks, wharves, or terminals for freight.

*Navigable depth.*

The navigable depth at mean low water along the quays of the Escaut at Antwerp is at least 8 meters (26.24 feet). In the present docks of this port the depth is now 7 meters (22.96 feet), but in the new docks now under construction the depth will reach 10 meters (32.8 feet). When the works now in progress at the port of Ostend are completed the depth at low water along the new quay, as well as in the new docks now being built, will be 8 meters (26.24 feet).

The depth of the entrances to the port of Ghent is 6 meters 30 centimeters (21.32 feet). The work now going on at this port is for the purpose of increasing the depth to 8 meters 75 centimeters (28.7 feet).

The temporary depth in the canal connecting Brussels with the Rupel will be 5 meters 50 centimeters (18.04 feet), and the permanent depth will reach 6 meters 50 centimeters (21.32 feet). At the pier of the port in course of construction in deep water at Zeebruge near Heyst, the depth will vary from 8 meters (26.24 feet) to 11 meters 50 centimeters (37.72 feet), and in the new canal from Zeebruge to Bruges 8 meters (26.24 feet). The navigable length and channel depths and widths at mean low water of the principal rivers and canals are shown in the map herewith attached.

*Increase of freight.*

From 1888 to 1901 the movement of heavy freight carried by the railway increased from 25,145,560 tons to 40,231,838 tons, and for the same period the full tonnage carried by inland waterways increased from 24,836,361 tons to 36,895,258 tons.

*Comparative rates by rail and waterways.*

On account of the differential rates on railways, as well as the variation in freight tariff on navigable waterways, due to various causes, such as greater or less commercial and industrial activity, unusual rise in rivers, frost, strikes, etc., it is difficult to obtain any

data relative to comparative rates for the carriage of freight by railway and by inland waterways.

*Development of inland waterways by canalization.*

There is a decided tendency toward the development of inland waterways by canalization of rivers, and construction of canals, and appropriating navigable waterways for the circulation of larger boats than those now in use, especially for the boats of the new canals in Germany, and those known as "Rhine boats."

*Money expended.*

The approximative amount of money expended by Belgium since 1831 for the improvement, construction, maintenance of harbors, canals, and canalized rivers is 690,000,000 francs ($133,170,000). Of the total amount expended for all purposes about 522,000,000 francs ($100,746,000) was spent in building and improving harbors, canals, and canalized rivers, and about 108,000,000 francs ($20,844,000) was expended in operating and keeping in repair canals, canalized rivers, locks, and dams. The present annual expenses for the last-named purpose amounts to 2,450,000 francs ($472,850,000).

*Statistics.*

The "Annales des Travaux Publics de Belgique" (Record of the Public Works of Belgium) and the "Annuaire Statistique de la Belgique" (Directory of Belgium's Statistics), annual publications, contain statistics stating the tonnage handled in or on the different ports, rivers, etc., and the last-named publication shows the movement of Belgian seaports.

*Materials and prices.*

Materials most generally used and prices of same are as follows:

| | Francs. |
|---|---|
| Concrete, per cubic meter | 18 = $3.474 |
| Masonry, brick, per cubic meter | 20 = 3.86 |
| Masonry, stone, rough, per cubic meter | 60 = 11.58 |
| Masonry, stone, cut, per cubic meter | 140 = 27.02 |
| Wood (pine) rough | 60 = 11.58 |
| Wood (pine) squared | 80 = 15.44 |

Iron and steel (rolled), per kilo (2.20 pounds) 0.35–0.40 franc = $0.067–$0.077.

GEO. W. ROOSEVELT, *Consul.*

UNITED STATES CONSULATE, *Brussels, November 4, 1903.*

[Translation.]

MINISTRY OF FINANCES AND PUBLIC WORKS,
ROAD-SURVEYING DEPARTMENT,
*Brussels, October 14, 1903.*

Mr. CONSUL: I have the honor to send you herewith information replying in the fullest measure possible to the questions you submitted to me concerning harbors, canals, and canalized rivers in Belgium.

I also inclose a copy of a map showing the dimensions of locks and depths of navigable rivers in Belgium.

Kindly accept, Mr. Consul, the expression of my distinguished sentiments.

J. P. FROOST,
*Inspector-General.*

(NOTE.—The illustrations and documents referred to in the above report have not been reproduced as a part of this document.)

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## ROTTERDAM, THE NETHERLANDS.

CONSULATE OF THE UNITED STATES,
*November 18, 1903.*

Hon. FRANCIS B. LOOMIS,
*Assistant Secretary of State, Washington, D. C.*

SIR: I have the honor herewith to submit a report on the Dutch waterways, as called for by department circular of May 8 at the request of Hon. T. E. Burton, chairman of the Committee on Rivers and Harbors of the House of Representatives.

I greatly regret the late appearance of this report, but it is due solely to my unavoidable absence on leave in order to bring the remains of my deceased daughter home for burial, and the subsequent illness of my vice-consul and clerk, A. H. Voorwinden, which two misfortunes occurring simultaneously naturally left the affairs of this consulate in a temporarily rather neglected condition. Since my return I have worked hard to bring all matters in order, but having all the routine work and accounts of the consulate to attend to I have had but little time for reports, and regret that this report perhaps is not as extensive as it might be.

I transmit with the report a map of the river Maas and the waterway at Rotterdam, and also (by even mail by bookpost) the following books and pamphlets, which, I think, contain all the information, not found in the report proper, desired by Mr. Burton, viz: Guide Communications Diverse. Bestek en Voorwarden, published by the Netherland department for waterways, trade, etc.; Guide to the New Waterway, and report of the Rotterdam Chamber of Commerce, the two latter published in the English language.

I have the honor to be, sir, your obedient servant,

S. LISTOE,
*Consul-General.*

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### REPORT ON DUTCH WATERWAYS, ETC.

The Government of the Netherlands annually makes appropriations through the States-General (Parliament) for the improvement of the rivers and harbors of the country; and, generally speaking, it can be said that the Government has paid for all the improvements and repairs made in the rivers and harbors and their approaches with the exceptions:

(1) The city of Rotterdam paid 10 per cent of the cost of the improvement of the so-called "New waterway" (of which a description in detail is given in the accompanying book, Guide to the New Waterway), during the years 1882–1896, which percentage amounted to the sum of 2,080,000 florins ($832,000).

(2) The city of Amsterdam paid 10 per cent of the cost of the last widening of the Northsea Canal.

(3) The cost of the building of docks, keys, inner harbors, etc., at the two great harbor cities, Rotterdam and Amsterdam, falls on these respective communities.

The digging and building of smaller harbors, as, for instance, at present at Delfzyl and Scheveningen, is, however, being done at the entire expense of the Government.

No tolls are charged on any of the government waterways or canals.

The works are sometimes done by the Government direct with hired labor, but usually contracts are let to the lowest responsible bidder. The contractors must, however, bind themselves not to pay any lower wages to the various workmen employed than that prescribed by the Government. (See p. 15 of the accompanying pamphlet, Bestek en Voorwaarden.)

No definite rules seem to exist as to what extent the Government or the interested communities construct docks, wharves, and other local improvements. The municipality of Rotterdam, for instance, builds its own docks, cranes, sheds, and warehouses; at smaller new harbors such improvements are often in whole or in part built by the Government.

The navigable depth of the principal harbors at mean low water is 7.5 meters. The difference between ebb and flood at Rotterdam is 1.20 meters, and Flushing 3.75 meters. At Amsterdam the waters are regulated by sluices.

The width of the navigable part of the Mass River is from its mouth as far up as Rotterdam about 300 meters. From Rotterdam to the German boundary line the width varies considerably. This river with its connections (the Rhine), the chief artery of commerce between the Netherlands and Germany, is navigable for vessels drawing up to 23 feet at average low water (28 to 29 feet at high water) from its mouth to the city of Rotterdam. From here to the German boundary, and, in fact, through to Cologne, in Germany, it is navigable for vessels drawing 8.10 feet of water at low-water mark, and about 12 feet at high water. The length of the river from Rotterdam to the German boundary is 175 kilometers (94.4 nautical miles).

As regards the increase, respectively, in recent years of freight carried by railways and waterways it can be stated that in 1898 the Dutch railways carried 1,973,503 tons freight, which was less than one-third of the Rhine traffic, which amounted to 6,449,375 tons. In 1902 the railway freight traffic amounted to 2,153,157 tons, against a river traffic of 8,197,989 tons.

The relative cost of transportation of freight by railways and waterways is, as I am informed by Mr. H. A. van Ysselstein, assistant city engineer of Rotterdam, according to German statistics, 1½ pfennigs (a pfennig is about one-fourth of an American cent) per ton per kilometer on the railways and 0.8 pfennigs per ton on the water-

ways. This comparison, I am informed, also holds good for the Netherlands.

There is at present no tendency or plans contemplated for the construction of new waterways, as the canal system of the Netherlands is considered as fully developed as the needs of the country demand. Improvements and repairs of the existing waterways is, however, yearly made, and new harbors, docks, and wharves will in the future undoubtedly be built gradually as the increasing business and traffic of the country may demand it.

The annual expenditure by the Government for river and harbor improvements is generally in the neighborhood of $2,000,000. In 1902 was expended 4,500,000 florins ($1,800,000). For 1903 is appropriated 5,000,000 florins ($2,000,000).

All the other information called for will be found in detail in the books herewith transmitted, viz, Guide Communications Diverse, Bestek en Voorwaarden, etc., published by the Netherland department for waterways, trade, etc.; Guide to the New Waterway and Report of the Rotterdam Chamber of Commerce for 1902, the two latter printed in the English language.

Further I append a condensed description of the new waterway and statement of the port charges at Rotterdam.

### THE "NEW WATERWAY" FROM ROTTERDAM TO THE NORTH SEA.

In 1847, the traffic through the Voornsche Canal, then the entrance from the sea to Rotterdam, amounted to 3,043 seagoing vessels, with a capacity of 1,483,357 cubic meters. In 1902, 7,086 ships, measuring 6,571,283 cubic meters, passed through the "new waterway," the present entrance.

Previous to the opening of the "new waterway," in 1872, vessels destined for this port entered from the sea by the Goereesche Gat, near the port of Hellevoetsluis, or by the Hellegat near the port of Brouwershaven, and after discharging part of their cargoes in lighters proceeded to Rotterdam by way of the Voornsche Canal, which was excavated in 1827–1829. Very small crafts only could enter the shallow mouth of the River Maas, at Brielle, and pass along the river to this city.

The depth of the Goereesche Gat at the port of Hellevoetsluis, which was 57 decimeters, and of the Hellegat at Brouwershaven, which was 52 decimeters, limited the draft of vessels, while previous to 1876 no vessels exceeding 71 meters in length could pass through the sluices of the Voornsche Canal. Since 1876, vessels measuring 110 meters in length and 13.7 meters in width could, by high tide and favorable weather, pass through the said canal. Under favorable circumstances the passage from the sea to Rotterdam took vessels not less than eighteen hours in those days, and even as late as 1880 it was no rare occurrence that from five to eight days were consumed in reaching this port from the North Sea.

In consequence of the urgent need for improvement, especially with a view to the increasing American trade, a committee was appointed by the Netherlands minister of the interior, in 1857, to formulate plans for the improvement of the fairway from Rotterdam to the sea. The eminent Dutch engineer, Mr. P. Caland, was secretary

of this committee. A depth of 70 decimeters at high water was decided upon as the proper depth for a fairway.

On January 25, 1858, Mr. P. Caland proposed that a new and open fairway be excavated, the entrance of which should be protected by piers extending into the sea to a certain depth, constructed in such a manner that the flood should enter in its full force. In order to retain the proposed depth, the volume of water which entered, increased by the water from the upper rivers, should flow off to sea during the ebb tide and carry river sand along with it. In other words, the entrance should be constantly deepened and widened by both high and low tides. Then the mouth and the fairway of the river Maas were to be normalized, the width to be gradually and proportionally decreased as the river extends inland. Although great difficulties would have to be encountered in carrying out this plan, as, for instance, the low sandy coast, the slight difference between the rise and fall of the water, and the proximity of sand banks near the mouths of the rivers, it was accepted and eventually accomplished according to Mr. Caland's ideas. The open fairway to the sea without sluices at the entrance, the "new waterway," is to-day considered one of the best results of modern engineering. Among the entrances of northwestern Europe it is the shortest and most accessible. Even during severe winters the ice flow is trifling, and no clearing of the river or channel by ice breakers is necessary.

The law of January 24, 1863, ordered the improvement of the waterway from Rotterdam to the sea in accordance with Mr. Caland's plan on the following general principles: The Maas River was to be widened at Krimpen to 225 meters, and from there the width was to be increased gradually until it would be 450 meters at the port of Vlaardingen and 900 meters at the Hook of Holland, with a sufficient depth. The entrance was to be between dikes connected with two piers or moles extending into the North Sea until a depth of 72 decimeters under average high water was reached. The total cost of this fairway to Rotterdam from the sea was then estimated at $2,520,000, and the work was to be completed in six years.

Excavating was commenced in August, 1863, and the entrance was opened on November 26, 1868. In September, 1870, the first two crafts, fishing boats, passed through, followed on July 10, 1871, by the first fishing smacks, while the steamship *Richard Young*, of the Rotterdam-Harwich Line, drawing 30 decimeters, was the first steamer to pass through the "new waterway" on March 9, 1872. The buoys indicating deep water were deposited on March 19, 1872.

The original plan of Mr. Caland in 1858, on which the estimate of cost and time was based, was to excavate a channel through the dunes at the Hook of Holland of a length of 4.5 kilometers (2.796 miles), a width of 50 meters, and a depth of 30 decimeters under low tide, which channel, as stated before, he supposed would be deepened and widened by both ebb and flood tides. This deepening process he thought would also affect the natural fairway from the excavated channel to Rotterdam, for the improvement of which $400,000 had been appropriated. In fact, Mr. Caland believed that nature would do the larger part of the work.

When the channel, which had been pierced through the dunes to form the new mouth of the river Maas, was opened to the sea in November, 1868, the piers extended into the sea to a depth of 40

decimeters under low water. The enormous quantity of sand ebbed out by the channel, however, caused bars in and in front of the entrance, and it was found impossible to remove these bars under existing conditions, though the piers were repeatedly lengthened until they extended into sea to a depth of 80 decimeters under the low-water mark. Between 1868 and 1880 not less than 7,250,000 cubic meters of sand passed through the channel into the sea. Of this sand 3,250 cubic meters were removed by the flood tides, but the remaining 4,000,000 cubic meters of sand caused a large bar at the entrance which checked the traffic and prevented the deepening of the channel by the flood tides, as had been anticipated.

Toward the end of 1879 the bar at the mouth of the channel had reached its largest proportions; subsequent thereto, owing to the steps taken to remedy the evil, it gradually decreased in size. At the end of 1877 already $5,000,000 had been expended on the channel, while it was estimated that $1,360,000 would still be required to give the channel the required width of 400 meters. The depth at low water was then 34 decimeters in a fairway 100 meters wide, while a narrow cut in the fairway, indicated by guiding lights, had a depth of 36.5 decimeters.

It had, however, before this become evident that though the principle of applying ebb and flood for deepening purposes was correct it would be impossible, in view of the conditions peculiar to the Netherlands coast and the river Maas, to rely upon it entirely. As further improvement of the "new waterway" was a necessity, a committee was appointed by the Government in 1877 to investigate the matter and form plans for the improvements that were to take place. Mr. W. F. Leemans, a leading Dutch engineer, was appointed in 1878 to carry out the plans of the committee. The committee made its final report in 1880, in which the principle of an open river was maintained. The proper width of the river was fixed at 250 meters at Krimpen, to be from that point downward gradually widened to 340 meters at Rotterdam, 450 meters at Vlaardingen, 530 meters at Maassluis, and 685 meters at the end of the northern pier at the entrance. It was further decided that the connecting waters between the Rotterdam waterway and the old mouth of the river and the inlet Botlek should be discontinued, and that the piers at the Hook of Holland were to be raised in height and to be lengthened to a depth of 90 decimeters by low water. By judicious alterations in the channel of the "new waterway," the connections between the "new waterway" and the old mouths of the river Maas were finally closed. After the natural removal of sand by the high tides had been properly checked, it was found, however, that the piers did not need raising or lengthening. The total amount appropriated for the improvements, as computed by the committee, was $12,000,000, of which $4,400,000 was to be applied for bringing about the disconnection of the two aforesaid inlets from the "new waterway" and the alteration of the piers. Pending the report of the committee no work was done to the waterway, but in 1881 the improvements were started and continued until the successful completion of the waterway in 1895. Ten per cent of the cost of improving the "new waterway" since 1881 has been borne by the city of Rotterdam.

From 1881 to 1896 $8,320,000 was expended on the "new waterway," making the total cost of that fairway $14,520,000. Between

Krimpen and the sea, on both sides of the river, not less than 23.5 miles of dams were constructed. The northern pier at the Hook of Holland has a length of about 1.25 miles; the southern pier of 1.43 miles, while the southern Lower Mole has the same length. An area of nearly 10 acres, forming the sides of the channel, are covered with stone, while a dam between Rozenburg and the old mouth of the river Maas has a length of more than half a mile, and contains a sluice which carries the sand removed by hoppers from the "new waterway" into the old river bed near Brielle.

Since the commencement of the work on the "new waterway," the quantity of sand removed from the river and channel between Krimpen and the sea amounts to more than 62,000,000 cubic meters, or nearly 22,000,000 tons. Most of the sand was removed by "sand-suckers." The annual cost of repairs to piers, sandsucking, etc., has for some years been about $180,000, which amount will have to be expended annually for some years to come.

The length of the waterway from the bridge crossing the river Maas at Rotterdam to the North Sea is 20.5 miles; the difference between high and low water averages at the Hook of Holland is 17 and at Rotterdam 13 decimeters. While it was supposed in 1880 that only a depth of 82 decimeters at the Hook of Holland and of 79 decimeters at Rotterdam could be reached, the depth of the river and channel at both places is now much greater. In 1897 it was 104 decimeters at the entrance, 100 decimeters between the piers, 82 decimeters from 4 miles inland to about 1 mile past Maassluis, 86 decimeters from there to Vlaardingen, and between this port and Rotterdam 90 decimeters.

Vessels with a draft of more than 28 feet can at the present date reach Rotterdam from the sea in two hours' time and discharge their cargoes at the docks and wharves of the city.

## PORT CHARGES.

The harbor charges at Rotterdam are moderate. There are no landing charges.

The tariff of tonnage or harbor dues on all seagoing vessels entering the harbor and making use of the moorings, docks, or berths along the quays is as follows:

*Steamers.*

| | Per cubic meter. |
|---|---|
| (*a*) Measuring 650 cubic meters or less | $0.012 |
| (*b*) Measuring more than 650 and less than 1,000 cubic meters | .014 |
| (*c*) Measuring more than 1,000 cubic meters | .015 |

*Sailing vessels.*

| | |
|---|---|
| (*a*) Measuring from 600 cubic meters or less | $0.020 |
| (*b*) Measuring 601 to 700 cubic meters | .024 |
| (*c*) Measuring 701 to 800 cubic meters | .028 |
| (*d*) Measuring 801 to 900 cubic meters | .032 |
| (*e*) Measuring 901 to 1,000 cubic meters | .036 |
| (*f*) Measuring 1,001 to 1,100 cubic meters | .040 |
| (*g*) Measuring 1,101 to 1,200 cubic meters | .044 |
| (*h*) Measuring 1,201 to 1,300 cubic meters | .048 |
| (*i*) Measuring 1,301 to 1,400 cubic meters | .052 |
| (*j*) Measuring 1,401 to 1,500 cubic meters | .056 |
| (*k*) Measuring 1,500 cubic meters or more | .060 |

The harbor dues are levied on the gross cubic meters, according to the international measurement (Moorsom's system), every time a vessel or steamer enters the port.

*Quay dues.*

These are as follows:

Seagoing vessels, per meter in length, $10 per year.

Other vessels per meter in length, $2 per year.

Inland boats, which obtain permission to moor, head to quay, per meter in width, $2 per year.

Vessels having permanent berths along the quays, like ships or regular lines and inland craft coming to the weekly market, in addition to the above charges, pay for being allowed to deposit goods temporarily on the quays. These additional dues are $0.04 per day for every 25 square meters or less occupied.

*Storage charges.*

The charge for the storage of goods in the city's public warehouses is according to the space occupied. The rate is $1.20 for every 100 square meters or less up to the first three days, and $0.40 for each succeeding day.

Quay space and warehouse room can be rented for long periods. Steamship companies which have built their own warehouses upon sites rented from the city for a term of years pay an average yearly amount of about $0.30 per square meter. Corporations permanently occupying quays with moorings pay quay dues, or $10 per running meter per year.

A table of storage charges in private Rotterdam warehouses is contained in Commercial Relations for 1901 (vol. 2, p. 575).

*Dry-dock charges.*

The tariff for making use of the floating docks is as follows:

| Gross tonnage of vessels in cubic meters. | Cost of entering and leaving dock.[a] |
|---|---|
| Vessels of 250 cubic meters or less to 400 | $0.036 |
| From— | |
| 401 to 450 cubic meters | .034 |
| 451 to 500 cubic meters | .032 |
| 500 to 750 cubic meters | .030 |
| 751 to 1,000 cubic meters | .028 |
| 1,001 to 2,000 cubic meters | .026 |
| 2,001 to 3,000 cubic meters | .024 |
| 3,001 to 4,000 cubic meters | .022 |
| 4,001 to 5,000 cubic meters | .020 |
| 5,001 or more | .018 |

[a] For the first five days, $0.012 per cubic meter per day. For subsequent days, $0.008 per cubic meter per day.

### *Crane charges.*

The cost of using movable steam and hydraulic cranes is as follows: Per day, $4; per half day, $2.40; for night work, $0.60 per hour.

For fixed cranes the rates are:

| Weight of articles. | Loading and unloading. | Transshipment, per ton. |
|---|---|---|
| 1.5 to 5 tons | $0.30 | $0.46 |
| 5 to 10 tons | .46 | .70 |
| 10 to 15 tons | .60 | .90 |
| 15 to 20 tons | .90 | 1.20 |
| 20 to 25 tons | 1.20 | 1.50 |
| 25 to 30 tons | 1.60 | 2.00 |

The minimum price paid for the hire of fixed cranes is $4.

### *Towing rates.*

[Not applicable when there is drift ice in the river.]

TO AND FROM ROTTERDAM.

From sea and all places in the new waterway below Maassluis to Rotterdam till first discharging or lightering berth, and from Rotterdam last loading, or ballasting place, down to sea by the new waterway, minimum towage, 5 pounds sterling; per ton of 2.83 cubic meters (gross tonnage), 9 pence ($0.18)—three-fourths of the towage money to be paid within twenty-four hours after arrival.

From sea and all places in the new waterway below Maassluis to Rotterdam till first discharging or lightering berth, minimum towage, 2 pounds 10 shillings sterling, per ton, 8 pence ($0.16).

From Rotterdam first loading and ballasting place to sea by the new waterway in one tide, minimum towage, 2 pounds 10 shillings sterling per ton, 6 pence ($0.12).

From sea to Maassluis, or vice versa, the Rotterdam tariff less 10 per cent is applied.

From sea to Vlaardingen or Schiedam, the Rotterdam tariff less 5 per cent is applied.

Moving and docking and swinging round on the river buoys:

| Net tonnage. | Per tug. | |
|---|---|---|
| | Moving. | Swinging. |
| 1,000 tons or less | $3.68 | $2.45 |
| 1,001 to 1,350 tons | 4.90 | 3.60 |
| 1,351 to 1,750 tons | 6.13 | 4.90 |
| 1,751 tons or more | 7.35 | 4.90 |

A map of the harbor and waterway at Rotterdam is also herewith transmitted.

S. LISTOE, *Consul-General.*

ROTTERDAM, *November 18, 1903.*

(NOTE.—The illustrations and documents referred to in the above report have not been reproduced as a part of this document.)

CONSULATE-GENERAL,
*Rotterdam, January 12, 1904.*

Hon. T. E. BURTON, M. C.,
*Washington, D. C.*

DEAR SIR: In reply to your inquiry of 19th ultimo in re Rhine barges I beg to say that I have sought information from several prominent shippers and river men, who all agree that the following is a correct statement of existing facts:

Rhine freighters or barges in the proper sense of the word never leave inland waters, which must be chiefly attributed to their unseaworthiness caused by low draft and disproportionate length. On the other hand there are certain firms who operate Rhine traffic with sea lighters, which latter, however, can not take full cargoes up to the interior and either bring part cargoes to Rotterdam or lighten there. The draft of lighters to Cologne under the most favorable circumstances is 9 feet.

The two principal concerns who go in for this sea-lighter traffic are the "Vereignigte Bugsir und Frachtschiffart Gesellschaft" and the "Hamburg Amerikanische Packetfahrt A. G.," owning, respectively, 35 and 33 lighters. Typical as belonging to the former company is the *Reichsanzeiger*, 672 gross register tonnage and drawing 14.2 feet; and of the latter company the *Saale*, 728 gross register tonnage, drawing 14.6 feet.

The former company carry several wood contracts, whereas the latter run the service regularly, partly as a feeder to the Hamburg-American Line's ocean service from Hamburg.

There is no barge traffic from Rotterdam to Antwerp via the open sea. The Rhine barges follow interstate rivers and canals to the latter city.

One firm here owns two barges, which are towed to England for coal, and that is the extent of the traffic on that country.

I am afraid this letter will not quite reach you on the 18th instant, but I desired to send you a statement made by parties, who could be considered authorities on this matter, and I had to await their pleasure; things do not move very quickly in Holland. I knew, of course, that no Rhine boats ever went out in the open sea, but wanted to be able to give you a statement from a reliable authority.

Hoping, however, you will receive this in time for your purpose, I am,

Very respectfully, yours, S. LISTOE,
*Consul-General.*

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## REPORT ON HARBOR AND RIVER IMPROVEMENTS AT ANTWERP.

In compliance with the terms of the department's instruction dated May 8, 1903, relating to river and harbor improvements requested by the Hon. Theodore E. Burton, chairman of the Committee on Rivers and Harbors of the House of Representatives, I have the honor to report as follows:

I. Improvements in the river and harbor of Antwerp are executed by both the Government and the municipality; never by private corporation or individuals. In the cost of these improvements there is

no apportionment, inasmuch as each of the above-mentioned bodies controls a different territory, i. e., the Government maintains the river and its navigable channels, lights, buoys, etc., constructs and keeps in repair the river quays, while the municipality constructs and keeps in repair the docks, sluices, dry docks, cranes, hydraulic hauling apparatus, etc. Each body therefore bears the expense of its own works.

Tolls are charged upon traffic upon canals or canalized rivers, and the amounts so collected are paid into the general treasury.

The works are carried out by contract and the method of letting same is by public adjudication.

II. As before stated, the Government makes all improvements in the open waters of the river, while the municipality constructs the docks and freight terminals.

III. The depth at the river quays at mean low water is 26 feet and at high water 39 feet, the range of the tide being 13 feet.

IV. The Escaut, or Schelde, on the right bank of which extends the city, forms a harbor 450 meters (1,476 feet) wide at high tide and 400 meters (1,312 feet) wide at low water. Antwerp is distant from the sea 54 miles (88 kilometers). At Doel, situated up the stream above the Dutch frontier, 43 miles (70 kilometers) from the sea, the river offers the aspect of a bay or branch of the sea.

The Schelde, or Escaut, has communications with the sea through four navigable channels—the Weilingen, the Spleet, the Deurloo, and the Oostgat.

The pass of Weilingen is the most frequented and the best. It is bound on the south by the plateau Het Zand and the banks of the Binnen Paardemarks, extending parallel to the coast; on the north by the Ribzand, comprising the banks of Heyst and Knocke and the banks of the Hompel.

The pass of the Spleet, bounded on the south by the Ribzand and the Hompel, on the north by the large plateau of the Raan and the banks of the Ellebog and the Walvischstaart, is navigable only for ships with a draft less than 5 meters.

Between the channel of the Deurloo and at the Oostgat lie the banks of the Rassen, the Zoutelande, and Calloo, forming a vast plateau. This channel is difficult of passage, on account of varying depths at its entrance, larger vessels being obliged to wait before passing half high tide.

The pass of Oostgat, used generally by ships coming from the north, follows the southwest coast of the island of Walcheren, joining the Deurloo opposite the lights of Kaapduinen.

The Nolleplatje, advancing in this channel to the west of Flushing, forces it toward the opposite shore. This bank protects the harbor of Flushing against northeast winds.

On the Escaut the bank of the Spykerploat is the southern limit of the harbor of Flushing. At this point the depth of water is between 7 and 8 meters (22–26 feet). To the east of the harbor is a high bank, called "Kaloote," the center of which shows itself at high water.

The large western entrance to the Escaut is bounded on the south by the banks of the Breskens and the Springer. These banks are formed by large plateaus above water at low tide, separated by waterways of inconsiderable depths.

To go through the Weilingen Pass ships coming from the English Channel bound for the mouth of the Escaut are obliged to pass northerly of the banks of Ruytingen and the southern Dyk, and southerly of the banks Fairy and Westhinder.

Up to September, 1882, the only guides to navigation on the Flemish coast were the floating lights of Westhinder and Weilingen. The approach to the pass of Weilingen was not free from danger, there being to the north of this channel the banks of Wandelaar, which at low tide are covered by hardly 7 meters of water.

To avoid these difficulties pilots had no other guide than the large buoy Wandelaar, painted black with horizontal red stripes, and surmounted by a sphere.

This buoy being difficult to sight by night or in foggy weather the board of pilots established a floating light of the first order about the center of the banks.

The light-ship *Weilingen* was also located more advantageously. The floating light Windelaar was maintained at its former position.

These improvements date from September, 1882.

Along the Escaut different lights indicate the channel to be taken by vessels. West of Flushing safe channels are indicated by numerous buoys.

On going upstream pilots leave to port the black buoys and to starboard the red ones.

## NAVIGABLE WATERWAYS.

The following enumeration of water courses and canals connecting Antwerp with its interior industrial and commercial centers as well as with the different countries surrounding it, together with a description of the various anchorages, will fully account for the amount of tonnage of the boats making use of these water communications for the purpose of inland traffic.

On the north the Hansweert Canal connects the Escaut with the southern canals of Holland, the River Meuse, and the Rhine. This canal has an anchorage of about 6 meters (19 feet) at low water and a depth of 8 meters (26 feet) at high water.

The locks have openings of about 15 meters (49 feet), allowing the passing of several Rhine boats at a time.

The Hansweert Canal, opened October 11, 1867, takes the place of the former ways of communication, which were up to that time through the southerly branch of the Escaut, closed by a dam at Woensdrecht. A second canal, that of Walcheren, passing through Middelbourg, replaces that of the Sloc, barred in 1871.

Antwerp is connected with the Meuse on the east by the Campine Canal and its several branches.

The canal joining the Meuse to the Escaut comprises three sections, the first constructed in 1843–44, the second in 1846, with a branch connecting Turnhout, and the third in the year 1856. The first two are of the grand section order since 1865.

This Meuse-Escaut junction canal has a branch connecting it with the military camp of Beverloo, situated at Bourg Leopold, and the town of Hassel. Another branch passes at Turnhout. The Meuse-Escaut junction joins at the Belgian frontier, near Bocholt,

the canal of Bois le Duc to Maestricht, built 1823–1826, widened in 1864–1870, to which is joined the Maestricht-Liege Canal.

Navigation upon the Meuse-Escaut junction canal is afforded by locks having an opening of 7 meters (22 feet) and a length varying between 50 and 56 meters (164–183 feet).

The anchorage in all these different canals has a depth of 2.10 meters (6 feet 9 inches), excepting the eastern branch at Turnhout, which has only 1.65 meters (5 feet 5 inches).

The Meuse-Escaut junction canal is also connected with the rivers Nethe and Rupel at Grobbendonck by the Little Nethe.

The port of Antwerp is connected on the south by the river Sambre with the manufacturing center of Charleroi and the north of France, viz:

(1) The river Rupel, subject to tidal variations, allows an anchorage varying from 1.60 to 5.25 meters (5 feet 3 inches to 17 feet 2 inches).

(2) The canal of Willebroeck, opened to navigation October 12, 1561, widened and deepened between 1830–1835 to allow an anchorage of 3.10 meters (10 feet). The maritime lock has an opening of 7.50 meters (24 feet 7 inches), and a length of 32 meters (104 feet 10 inches).

(3) The canal of Charleroi, constructed in 1832, enlarged and improved between 1854–1857, has an anchorage of 2.40 meters (7 feet 9 inches), with locks measuring 5.20 by 40.80 meters (17 by 133 feet).

Canal boats of large dimensions can run between Antwerp and Charleroi, with a draft of water of 2.40 meters (7 feet 9 inches). The locks are sufficiently large to allow the passage of boats of 300 tons burden.

The canal of Charleroi to Brussels, joined to the Sambre River and to the canal of the Sambre and d'Oise, has an anchorage of 2 meters (6½ feet), with locks having openings of 5.20 meters (17 feet) by 37.40 to 37.60 meters (122–123 feet) in length.

This canal is, furthermore, connected with the Meuse, near Namur, by the lower part of the canalized river, Sambre, allowing anchorage of 2.10 meters (6 feet 9 inches), passage of 5.14 meters (16 feet 9 inches), and a length of locks from 45.65 to 47.26 meters (150 to 155 feet).

The river Meuse, canalized 1870–1880 between Namur and the French frontier, has a draft of water of 2.10 meters (6 feet 9 inches) and locks with openings of 12 meters (39 feet 4 inches) and 100 meters (328 feet) in length. This canal connects the southeast section of the canals to that of the French Ardenne section.

The port of Antwerp is also in communication with Louvain, by the Rupel and the canal Louvain, as far as Sennegat. This canal, opened in 1752, was considerably improved from 1760 to 1763, and then again between 1836 and 1837. Its depth is 3.60 meters (11 feet 9 inches), and its locks have passageways of 8.20 meters (26 feet 10 inches) in width, with lengths of 56 meters (183 feet).

The lower Escaut is connected with all the navigable section of the north of France in the following manner:

First. Directly by way of the upper Escaut from Ghent to the French frontier, with a minimum draft of water of 2.10 meters (6 feet 9 inches), and locks measuring 6.50 by 41.60 meters (21 by 134 feet), and in the French section with anchorages of 2 meters

(6½ feet), with locks 34 meters (111 feet) in length and openings varying from 5.20 to 6.40 meters (17 feet to 20¾ feet).

West of Audenarde, it communicates with the River Lys through the canal of Bossuyt Courtrai, constructed in 1858–1863, with an anchorage of 2.20 meters (7 feet 3 inches) and locks 5.20 by 37.65 meters (17 by 123½ feet), and with the Deule by the Canal d'Espierre and that of Roubaix, with a draft of water of 2 meters (6½ feet) and locks 38.50 and 39.60 meters (126 and 129 feet), with openings of 5.20 meters (17 feet).

At Antoing, the lower Escaut meets the Pommeroeul-Antoing Canal, Canal Mons-Condé, having anchorages of 2.20 to 2.30 meters (7 feet 3 inches to 7 feet 6 inches) with locks of 40.80 meters (133 feet), affording a width of passage of 5.20 meters (17 feet).

The Escaut on French soil receives the Scarpe, navigable as far as Arras, with a water draft of 2 meters (6½ feet), while at Condé it meets the Canal Condé to Mons (Belgium). This waterway, up to the point of junction with the Antoing Canal, has only a draft of 2 meters (6½ feet), with locks 5.20 by 37.50 meters (17 by 123 feet). Beyond, anchorage varies from 2.20 to 2.40 meters (7 feet to 7 feet 8 inches), and the length of locks 5.20 to 41.06 meters (17 by 134 feet).

Very important work has been done to make a connection between the Mons-Condé Canal and the Central Branch, near Houdeng, so as Escaut via the Antoing-Mons Canal to the Canal of Charleroi, which offers an anchorage of that depth. The locks of all these canals have a measurement of 5.20 meters in width by 40.80 meters in length (17 by 133 feet).

Mechanical appliances are in process of construction, viz, four hydraulic elevators for boats for the purpose of enabling them to overcome the difference of level of 66.30 meters (217 feet). One of these elevators is now in use at Houdeng.

At the present time the Central Canal is operated by mechanical appliances throughout two-thirds of its course.

This connection of the Mons-Condé Canal with the central branch will bring about direct communication, by means of a broad canal on Belgian territory, between the plain of the upper Escaut and the valley of the Sambre.

The upper Escaut is joined to the St. Quentin Canal, the canal of the Somme via Ham, and to the canal of the Oise by a branch communicating with the canal of the Sambre at the l'Oise. Navigable in all its courses for vessels of 2 meters (6½ feet) draft, it has locks of 31 meters (101 feet) with passageways of from 5.20 to 6.40 meters (17 to 20¾ feet).

The canal of the Sensée joins it to the Scarpe and the Deule, at Douai, France.

An existing project for a northern canal toward Paris would strike the canal of the Sensée, reaching the canal of the Somme near Péronne, following the direction from Ham to Paris, with anchorages of 2.20 meters (7 feet 3 inches) and locks 5.20 by 38.50 meters (17 by 126 feet).

Another plan would be to effect a direct junction of the upper Escaut with the Meuse by a branch connecting the Escaut with the Sambre between Denain and Landrecies, and the Sambre with the Meuse from Landrecies to Mézières, with anchorages of 2.20 meters (7 feet 3 inches) and locks 5.20 by 38.50 meters (17 by 126 feet).

Second. The lower Escaut is further connected by the Dendrée (canalized 1863–1867) from Termonde to Ath, with a depth of water from 2.10 to 2.30 meters (6¾ to 7½ feet) and locks 5.20 meters (17 feet) by 41.77 meters to 42.65 meters (137 to 143 feet) long. The Canal Blaton to Ath, constructed in 1868, places the Dendrée in communication with the Canal Pommeroeul to Antoing and its several branches.

Third. By the river Lys, which in its course from Ghent to the French frontier toward Armentières has anchorages of 2.10 meters (6 feet 9 inches), with locks 5.20 meters by 42.20 meters (17 by 138 feet).

The Lys is connected with Roulers by a branch constructed in 1872, and to the Escaut by the Canal Bossuyt to Courtrai.

On the French frontier the Escaut reaches Lille and Douai by the canal of the Deule, having anchorages of 2 meters (6½ feet) and locks 5.20 meters (17 feet) by 38.70 to 40.40 meters (126 to 132 feet).

In France this river is connected with the canals of Aire and Neufossé and their ramifications. Lastly, the Escaut is in communication with the western section of Belgian canals in the following manner:

(1.) By the Durme and its branches.

(2.) By the canal of Ghent to Bruges of the grand section order, with a depth of water of 2.50 to 2.90 meters (8 feet 2 inches to 9 feet 6 inches), extending between Ghent and the canal from the source of the Lys, and a depth of 2.20 to 2.50 meters (7 feet 3 inches to 8 feet 2 inches) from this point up to Bruges.

Also by the Canal Bruges to Ostende, having a depth of 4.30 to 4.50 meters (14 feet to 14 feet 8 inches), and which, branched to the canal of Plasschendaele, has an anchorage of 2.25 to 2.50 meters (7 feet 4 inches to 8 feet 2 inches) up to Nieuport, and of 2.20 meters (7 feet 3 inches) from Nieuport to Furnes. This canal is in direct communication with the Yser, joining it to the canal of Ypres, which has a depth of 1.70 to 2.25 meters (5 feet 6 inches to 7 feet 4 inches), and a lock 6.20 by 37 meters (20 by 121 feet).

The canal of Ypres to Commines, in course of construction, will add to all these different routes of communication a way to the basin of the Lys, by the use of locks 5.20 by 45.50 meters (17 by 149 feet), with anchorages of 2 meters (6½).

The canal of Loo, with an anchorage of 1.90 meters (6 feet 3 inches), unites the Yser to Furnes.

The canals of Furnes to Dunkerque, and that of Furnes to Bergues join the canal of Nieuport to all the navigable sections of the Pas de Calais, but they have a draft of water of only 1.25 to 1.30 meters (4 feet to 4 feet 3 inches), which ultimately will be increased to that of 2 meters (6½).

This vast system of navigable waterways to Antwerp, covering an area of over 2,000 kilometers (1,243 miles), is a medium conferring great facilities for transportation.

From statistics given by the bureau of hydraulics, the total amount of inland transportation, consisting of coal, coke, minerals, metals, plaster, lime, cement, stone, slate, marble, ceramics, and glassware, wood, agricultural products, and general merchandise, was estimated for the year 1893 to have been, in tons of 1,000 kilograms (2,204 pounds), as follows: Through the upper Escaut and the Dendrée,

east of Termonde, 906,700 tons. Through the Rupel and its annex of canals, 1,462,000 tons. Through the Rupel and its annex of canals, 1,462,000 tons. Through the lower Escaut, west of Antwerp, 1,910,000 tons. By way of the Junction Canal from the Meuse to the Escaut and by that of Turnhout, 791,000 tons.

The total movement in transit by inland boats on the Escaut west of Antwerp amounted to 1,895,497 tons on incoming and 1,627,476 tons on outgoing boats, giving a total for 1893 of 3,522,973 tons, as compared with 3,500,000 in 1881.

The period embracing the most rapid development of inland navigation in Belgium occurred between the years 1820 and 1860.

The following statistics give the increase by periods of ten years:

*Canal development in Belgium.*

| Years. | Area. | Amount added. |
|---|---|---|
| | *Meters.* | *Meters.* |
| 1820–1830 | 1,518,444 | |
| 1830–1840 | 1,707,120 | 88,676 |
| 1840–1850 | 1,818,520 | 111,409 |
| 1850–1860 | 1,919,731 | 101,202 |
| 1860–1870 | 1,976,011 | 56,280 |
| 1870–1880 | 2,022,919 | 46,908 |
| 1880–1890 | 2,036,719 | 13,800 |

1 meter = 3 feet 3.37 inches.

This progressive movement ceased when, owing to the greater convenience and rapidity of transport by that means, the establishment of numerous railways diverted traffic, though in many instances at much greater expense.

Latterly attention has been given principally to the improvement of existing canals, widening or deepening certain ones so as to obtain more direct communication with others and render it possible for boats to pass through at all points, making them conform to an uniform type and be of depth adapted to present commercial necessities.

V. The increase of freight carried by rail to and from the port of Antwerp from 1870 to the end of 1901 is shown by the following table:

| | Tons. |
|---|---|
| 1870 | 968,074 |
| 1875 | 2,180,314 |
| 1880 | 3,179,089 |
| 1885 | 3,304,925 |
| 1890 | 4,860,705 |
| 1895 | 5,774,454 |
| 1900 | 6,661,299 |
| 1901 | 6,351,088 |

The increase of freight carried by inland waterways to and from Antwerp for the same period will be seen by reference to the table below:

| | Tons. |
|---|---|
| 1870 | 1,726,484 |
| 1875 | 2,431,234 |
| 1880 | 2,847,950 |
| 1885 | 3,913,429 |
| 1890 | 4,751,399 |
| 1895 | 5,923,682 |
| 1900 | 6,192,462 |
| 1901 | 6,334,798 |

VI. The rates of freight by rail as compared with those by inland waterways are from 40 per cent to 50 per cent more expensive.

VII. In the opinion of one of the most eminent expert engineers of the country the canals system of Belgium may now be considered complete.

VIII. The total amount expended up to the year 1897 by the Belgian Government for improvements, construction, maintenance, and repairs of rivers, harbors, and canals was $116,862,284.

Of the total amount thus expended, according to the official statistics, $84,978,800 were spent in construction and the balance in maintenance, repairs, etc.

The average annual cost may be estimated at $500,000.

In 1895 $8,300,000 were voted by the Government for the construction of the port and canal of Bruges. In 1896 the Government, the Province of Brabant, the city of Brussels, and the outlying towns of Molenbeek, Schaerbeeck, St. Gilles, Anderlecht, St. Jesse ten Noode, Ixelles, Koekelberg, Etterbeeck, Laeken, and Vilvorde formed a corporation for the construction of a port at Brussels and the enlargement of the canal from Brussels to the Rupel. The initial outlay has already been $2,858,300.

IX. The department of finances and public works publishes annual statistics stating the tonnage handled in the different ports, rivers, and canals and the value of same.

X. Subdivision (*a*) of this question is as fully dealt with as possible in the answer to the fourth question. With regard to subdivision (*b*), (*c*), (*d*), and (*e*) all attempts to obtain this information have so far failed, there being no accessible documents containing the same.

XI. The nature of the engineering work carried on is either dredging or masonry constructions.

GEO. F. LINCOLN, *Consul-General.*

CONSULATE-GENERAL OF THE UNITED STATES OF AMERICA.
*Antwerp, June 23, 1903.*

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AMSTERDAM, THE NETHERLANDS.

CONSULATE OF THE UNITED STATES.
*September 25, 1903.*

Hon. FRANCIS B. LOOMIS,
*Assistant Secretary of State, Washington, D. C.*

SIR: I have the honor to transmit, under separate cover, report called for in department circular dated May 8, 1903, on harbors and rivers of the Netherlands, the same having been returned on September 24, 1903, from the legation at The Hague, where, on direction of the minister it was sent August 14, 1903.

I am, sir, your obedient servant,

FRANK D. HILL, *Consul.*

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Replying to the circular of the Department of State, dated May 8, 1903, on harbor and river improvements, I have the honor to submit the following report:

According to the Statesman's Year Book for 1902, the length of navigable water (canals excluded) in the Netherlands is about 3,000

miles. The total length of canals in 1899 was 1,907 miles; of roads 2,943 miles. In 1899 the length of the principal tramway lines was 727 miles, 53,697,000 passengers were carried, and 671,547,000 kilograms (1,477,403,400 pounds) of goods. Receipts from them amounted to 6,131,000 florins ($2,464,662). The total expenditure devoted to state railways up to to 1898 was 270,509,000 florins ($108,744,618).

In 1900 the railways had a length of 1,730 miles, of which the State owned 969 miles and private companies the remainder. It may be stated here, however, that even the state lines are operated by private people.

The railway receipts have been as follows since the year 1890:

| Year. | Revenue. | Expenditure. | Goods carried. | Passengers carried. |
|---|---|---|---|---|
| 1890. | | | | |
| | *Guilders.* | *Guilders.* | *Kilograms.* | |
| State railway companies | 14,872,000 | 7,833,000 | 4,715,000,000 | 6,664,000 |
| Private railway companies [a] | 12,431,000 | 7,300,000 | 2,376,000,000 | 10,306,000 |
| 1897. | | | | |
| State railway companies | 21,390,000 | 17,364,000 | 6,824,000,000 | 11,009,000 |
| Private railway companies | 16,314,000 | 12,380,000 | 3,596,000,000 | 14,013,000 |
| 1898. | | | | |
| State railway companies | 22,044,000 | 17,509,000 | 6,199,000,000 | 10,828,000 |
| Private railway companies | 17,376,000 | 13,053,000 | 3,833,000,000 | 15,206,000 |
| 1899. | | | | |
| State railway companies | 23,306,000 | 18,939,000 | 7,060,000,000 | 11,733,000 |
| Private railway companies | 18,060,000 | 13,890,000 | 4,141,000,000 | 16,131,000 |
| 1900. | | | | |
| State railway companies | 23,789,000 | 20,809,000 | 7,274,000,000 | 12,257,000 |
| Private railway companies | 18,863,000 | 14,829,000 | 4,386,000,000 | 17,761,000 |

[a] In 1890 one of the private companies was appropriated by the State.

The ministry of the waterstaat, which was consolidated with trade and industry and made into a new department in 1877, had allotted to it last year over $13,000,000 out of a total governmental expenditure of $66,000,000 for the support of the country. This was the largest item in the budget and testifies to the importance of waterways in the Netherlands.

The engineering problem here is to keep out the outer waters—that is, those of the ocean and rivers—and expel the inner, caused by overflow or rainfall, and which have settled in the morasses, marshy pools, and soft fens. Half of Holland is below the level of the outer waters, from which it is guarded by dikes and dunes (see article on "Dutch dikes and dunes" in the National Geographical Magazine, Washington, D. C., in 1901), and it is through these protecting walls that the inner waters must be carried out.

The following from David S. Meldrum's Holland and the Hollanders is an excellent nontechnical account of Dutch waterways:

Since the middle ages the Dutch have been reclaiming their country from these inner waters. There is a tradition that as early as the beginning of the fifteenth century a hydraulic windmill was set up near Alkmaar. Early in the next, it is probable, impoldering was in general practice on a small scale. In 1600, we know, the Zype, in the

north of North Holland, was drained. By 1625 the Purmer, the Wormer, the Beemster, the polders to the north of Amsterdam, which every stranger visits, as well as those to the east of Stavoren, and between Workum and Hindelopen, had come into existence. The Schermer followed soon after. In 1643 Adrianz Leeghwater published a scheme for draining 17,000 acres of that inland sea. Two hundred years later his dream was being realized by the aid of steam. Between 1833 and 1877 Holland had increased from 8,768 square miles to 12,731 square miles. In that extension were included, besides the bed of the Haarlem Lake, the Y polders created by the drainage of the Y at the making of the North Sea Canal. Comparatively there remains little of value to be reclaimed in the interior, and the Dutch are turning wistful eyes upon the Zuider Zee. If they do not attempt to drain it, the reason will be that they do not think the enterprise worth their while and not because they are afraid to essay it.

The Haarlemmer Meer, we have seen, was a monster that for three centuries swallowed land and villages and smaller lakes, growing ever greater and more ravenous, until in 1836 it almost devoured Leiden and Amsterdam themselves. Leeghwater's scheme in the seventeenth century contemplated the draining of 17,000 acres only, and by means of 160 windmills. In the next two hundred years a full score of plans were put forward to get rid of the evil that every day was becoming greater. One of them, Baron van Lynden's, proposed that steam should be used, and its author was at the head of the commission which actually took in hand the work of draining by steam mills, after the tempests of 1836, by which time, possibly, nothing but steam power would have availed. The Meer, even in normal conditions, was now over 45,000 acres in extent, and the annual cost of keeping it within these bounds involved an expenditure that would have furnished forth a herring fleet. The water to be drained was some 800,000,000 tons at the start, with another hundred millions, or more, to come from rainfall and infiltration, all below the lowest possible point of outfall. To lift this body of water out of the country, and so empty it into the outer waters, that was the undertaking.

Except for the magnitude of the operations, however, there was nothing unusual in the plan of working. A canal was dug encircling the lake, and the excavated earth helped to build the encircling dike on the inner side. Earthen dams plugged up the inlets. The monster was at least caged. Then engines were planted at different points on the dike. In May, 1848, pumping began, and by July 1, 1852, the lake was dry. Along the length and breadth of the newly drained territory canals were dug, and the whole area was further divided into sections by smaller canals and ditches, and the sections were sold. Two years later they were fields of splendid colza, with the bees busy in the golden crop.

That is the usual course of impoldering; but here it was carried out on a gigantic scale. Figures are an inadequate means of realizing the undertaking, but with the help of figures one must be content. The encircling canal is nearly 40 miles in length, and as wide as the Thames at Shepperton. It had not merely to receive the pumped-out water; the lake traffic had to be carried on by it as well. For making the dike, the earth from the canal was not sufficient, as the sand diggings at Bennebroek still show. Canal and dike together

cost £160,000. The area of water they inclosed was over 70 square miles. An English firm designed an engine capable of discharging 1,000,000 tons of water in a little over twenty-five hours, and three such engines were built, and set to work upon the 1,000,000,000 tons. To build them in position and to keep them running cost an additional £200,000. One, the Leeghwater—all three were named after famous Dutch hydraulic engineers—was placed at the southwest corner, and pumped the waters into the Kager Meer. From there they were carried down the Warmonder Lee to the old canal from Leiden to Haarlem; from this canal another joining the old Rhine near Katwyk was dug to receive them, and in consequence of this influx of waters into it the works constructed at Katwyk forty years earlier for lifting the river into the sea had to be made stronger. The Cruquius, again, was placed halfway up the west side of the lake, on the Spaarne, which then flowed past Haarlem and fell into the Y at Spaarndam. Here was a natural exit for the water pumped by this engine. The third engine, the Lynden, is at the north end. The water raised by it was led into the small Lutkemeer (impoldered since then), and from there into the encircling canal, which had an outfall into the Y near Halfweg. By these three engines the lake was drained in exactly four years.

But they are still at work. Infiltration here, as in most Dutch meadows, is a constant danger; and the polder, too, is deeper at the center than at the sides. Over such an area the rainfall is considerable. So the engines have to raise some 54,000,000 tons of water 16 feet, on the average, annually. The two main transverse canals are each 80 feet wide, while six of less width cross the breadth of the polder and four the length. The land reclaimed in all is 41,675 acres. One hundred and thirty miles of roads cross the polder, and the canals are spanned by 60 or 70 bridges.

The total outlay on the work was about £800,000, and it has been fully repaid. A foreign syndicate came forward with an offer to buy the whole polder at the rate of £10 per acre. At the latest sale of reclaimed land of the same kind, previously, the average price realized was under £6 an acre, so that this offer seemed good; but owing to certain conditions in the issue of the drainage loan it was not accepted. A year after the draining of the lake there was a first sale of some 2,000 acres of which the city of Leiden claimed the ownership. Before the auction opened a protest was lodged, on behalf of the city, against the sale, and purchasers were threatened with proceedings if they attempted to settle on their lands. The Government checkmated this by a guaranty to all purchasers of undisturbed possession. The sale then went on, and the price realized on the average was not £6 or £10, but £24 16s. 8d. per acre.

A very much higher price, it is worth noticing, was obtained for the reclaimed lands in the Y polders which were drained in the construction of the North Sea Canal, one of the engineering triumphs of the century. The 12,450 acres realized £80 on the average. Some of the ground, of course, was very near Amsterdam, and suitable for building upon, and it sold for as much as £340 per acre. This brought up the total yield; still, £112 per acre was paid in some cases for agricultural land. As has been said, the new polders generally have been bought at too great a price, and as a result agricultural enterprise is hampered by the high capital value.

And yet the Dutch are dreaming dreams of still greater conquests. At Nieuwe Diep we take a fishing boat of Oudeschild and sail from the mainland to the island of Texel. The strait, in which some naval cruisers are maneuvering, was once the mouth of the Ysel; the half-crescent of islands—Texel, Vlieland, Terschelling, Ameland—was part of the mainland then, and the Zuider Zee did not exist. Some token of that is given by the sand banks that show their bright tops in the cold sunlight on our left. To the right, and behind us, lies the island of Wieringen, like a row of enormous poles topping the water. Farther south, north Holland shoots out a spur, a line of blue, into the mists of this wonderful sea. For the sweep of an arm the horizon line is the meeting of sky and water. Here it seems are boundaries of nature's own delimitation, not to be revised. But the Dutchman does not think so. In his ambitious imagination the scene upon which we are looking takes another shape. He sees a gigantic highway running from north Holland to Wieringen, and from Wieringen again to the mainland of Friesland. The fisher craft have disappeared from the sea within. Its bays are become rich pastures; fields stretch from Wieringen to Medemblik, from Stavoren to Kampen, the bight of Hoorn is dry, and the south shore of the Zuider Zee is a straight dike from the Ysel to the Y. There is no longer a Zuider Zee, indeed, but only the inland lake of the waters of the Ysel, which discharge at the sluices at Wieringen; and the dead cities have come to life again.

That or something like it has been the dream of Dutch men for fifty years, now—ever since the Haarlem Lake was drained. Still, they hesitate to try to realize it, chiefly because they are not certain that if the Zuider Zee were made dry they should find a fertile bed like that of the Haarlemmer Meer or that of the Y. Convince them that they should, and no doubt they would start upon the drainage works to-morrow, with a light heart for all the obstacles between them and the reclaimed hectares. Yet the obstacles are enormous. Consider, for one: Into the sea that it is proposed to impolder there falls, at Kampen, the river Ysel. How will the waters it pours into the Zuider Zee be got rid of? Build a dam to Den Helder, and carry on it to the North Sea, as through a town's waterpipe, a river like the Medway? That has been seriously proposed. If the work is undertaken, however, it will be in all likelihood on the lines of the scheme presented in 1892 to the Government by the Zuider Zee Association, the engineer of which was Mr. Lely, now the minister for waterstaat. The Government submitted the plan to a royal commission, who reported upon it favorably; and it is on it that is based the ambitious scheme of the Hollanders as I have described it. Let us examine it more in detail.

The island of Wieringen supplies the natural starting point for the works. Between north Holland and Piaam, in Friesland, from mainland to mainland across Wieringen is some 30 or 35 miles; and right along the 25 miles of this distance between the island and Friesland is to run an embankment, with a height of 17 feet 8 inches on the average above sea level at Amsterdam and a breadth at sea level of 216 feet. The actual summit of the dike will be between 6 and 7 feet broad; but a little lower on the inner or Zuider Zee side a level stretch of 55 feet 9 inches in width will carry a railroad and the ordinary traffic. It is estimated that the building of this embank-

ment, which is to be begun at Wieringen and the mainland of Friesland simultaneously, will take ten years. Between Wieringen and the north Holland mainland is the Amsteldiep. This will be closed. At Wieringen are to be constructed two sets of locks. To keep out an enemy's ships, the locks will be small: One, 320 feet by 33 feet; the other, for fishing boats, 131 feet by 20 feet. These finished, empoldering may be begun.

In the center of the Zuider Zee will be left a large lake, the Ysel Meer, as a storehouse for the waters of the Ysel. The northernmost polder will consist of some 30,000 acres, inclosed by the dam of the Amsteldiep and a dike sweeping round from Wieringen to Medemblik. On the Friesland side a dike from about Stavoren to near the north bank of the Yselmouth at Kampen will shut in 200 square miles, while a third, widely encircling the Golden Sea, will add a hundred square miles to north Holland. Finally, nearly 400 square miles will be reclaimed from the south bight between Amsterdam and the Ysel. In all, a province as large as Zeeland will be added to Holland, reclaimed and kept drained. The dikes will keep out the Ysel polders are reclaimed and drained. The dikes will keep out the Ysel Meer and the inside waters will be raised step by step till they can be poured into the outer waters. If the works were to be begun now, the 800 square miles might all be under the plow by the middle of the twentieth century—scarcely before; but as actual reclamation can be carried on from the start, long ere then some portions of the bed of the Zuider Zee would be yellow with colza. At least £30,000 will have to be spent on the transformation. We were right in saying that the Hollander takes long views.

All this may help us to realize the magnitude of the work of reclamation in great and notable polders like those of the Haarlemer Meer and the Y-basin—of reclamation in the first instance, and of keeping them dry from hour to hour and from day to day ever afterwards. But the drainage of the largest polder is not to be considered by itself; it affects the drainage of the whole country. A polder is any basin made dry, and the greatest polder of all is the whole lowlands of Holland. They lie below the level of the outer waters; they were a swamp, if not a sea; and just as the smallest polder, once drained, has to be kept drained, so the whole of the lowlands reclaimed from the waters are kept reclaimed only by continual and strenuous labor. Thus the drainage of the country is one system, in which the smallest polder equally with the largest has its definite place and interest; proof once more that the safety of Holland may be a question merely of half an inch of water.

Besides the works of reclamation within the country, the greatest of which, finished or in contemplation, have just been described, there is going on constantly, on the broken fringes of Groningen and Friesland, and of the islands of Zeeland, a system of impoldering from the sea. The conjoint action of nature and of man in these sea polders is this: The ocean leaves against the dike faces, rapidly at first, more slowly as the deposit mounts higher, layer upon layer of clay that at last keeps a dry head above the waters save at high tide. This wet sea-washed clay is known as "slikken," and is deposited chiefly in the months when the wind is off the land, and the jabble of the tides consequently less; these months are known locally as "slik maanden" (slik months). Once lifted above the ordinary sea

level, the slikken become covered with growth, first with sea coral and afterwards with sea grasses, and are then known as "kwelders." Upon the kwelders agriculture is not possible, for the high tides still overrun them; but sheep and cattle are put upon them to graze. At length, when the soil has mounted sufficiently high to seem to justify impoldering, they are encircled by dikes, after the system we have seen followed in all polders, and the work of reclamation goes on apace. Such is the process at work constantly all along the broken coasts of Holland. Standing upon any of the sea dikes there at ebb tides, we observe toward the sea, first the grass-grown kwelders, then the kwelders covered with sea kale, farthest out of all the brown slimy slikken left exposed by the falling waters. If we look inland, there, as likely as not, is an inner dike, perhaps another dike within that again, once the defense against the sea, but now high and dry amid the reclaimed fields. I can not give a better idea of the practical work of sea impoldering always proceeding on these coasts than by quoting, from the Rotterdamsche Courant of one day in April last, the following from its correspondent in Hunsingoo, in the extreme north of Groningen:

The province of Groningen grows continually in the north. The sea is busy day after day, and the progress it makes in a short time is astonishing. The farmers have dug ditches, running from south to north, with little straw-covered mounds on their side that bear the name of "dogs." These "dogs" and ditches are real mud catchers, and their cost in wages to the farmer is soon repaid. The formation of the soil spreads from the west to the east. Behind Pieterburen and Westernieland it goes on rapidly. Fifteen or twenty years ago there was a decrease of land noticeable behind the Andel; but now there is an increase again, and behind Usquert, and especially behind Warfum, the new soil is plainly to be seen. The north polder, stretching from Westernieland to Usquert, was diked in in the year 1811, and now the sea can be seen forming a new polder. When it will be diked in is uncertain; so soon, at any rate, as the farmers see that impoldering will repay them. The outer fringes of the province, the kwelders, are of great importance as meadow land. Horses and cattle are put upon them; but above all, sheep, the rearing of which, as it happens, is a profitable business in the country just at present. The great drawback to the kwelders is, of course, that when the northwest wind blows they are flooded and for days are useless. To mitigate this the farmers have had some 40 hectares behind Westernieland and Pieterburen surrounded by a summer dike of a few meters in height, with conduits so constructed below them that the water can flow out of them, but can not enter. This dike, however, suffered greatly by the storms of February. A few day laborers contracted to restore it, but their work did not satisfy the farmers, who stopped it accordingly, and took the repairs in hand themselves under the direction of a surveyor. These small indikings are forerunners of the greater ones.

So much, by way of popular description, for the polders and the drainage works of the waterstaat. It is necessary to say a word about the dikes. The reader is now acquainted with the river dike at Maurik that protects the orchards of the Betuwe from the irruptions of the Rhine. It is faced with a layer of fascines, and covered, save on the roadway, by a coat of green turf. At dangerous spots it is strengthened by basalt, and it is supported in places by piles. It is a good example of an important river dike. Later on, at Helder and at Domburg, we shall visit the still greater bulwarks of Holland against the ocean. Giant dikes like these stand upon immense rafts of earth and stones sunk one upon another in the water; they are girded with granite, and tower above the ocean, whose thundering tides are broken against their basalt greaves. We can learn, if we wish, all about their height and weight and cost. Here, we have

to remember chiefly that it is only on account of their magnitude that they are to be considered by themselves; that the simplest mound round a polder belongs to the same system as the West Capelle, which has cost in upkeep its own weight in copper.

The whole of the low-lying area of Holland which requires protection from the outer waters is divided up into sections of varying extent. In some cases the boundaries of these sections correspond with the boundaries of the communes. In almost all they are fixed in view of the parity of interests concerned in the defense against the water. Each of them is known as a waterschap, and the legislation for these waterschappen and the administration of their affairs is of the highest interest and importance. But before they can be properly understood it is necessary to realize clearly how closely the waterschappen are linked in a common system. The simple polder is surrounded by a dike that keeps the outside waters from entering it and makes it possible to regulate the level of the waters within. The superfluous inside waters are pumped out of it into a lake, river, canal, or other convenient basin, and several such storage basins at the same water level encircled by dikes and dams make what is known as a boezem. But the same water sometimes belongs to more than one boezem; in which case, of course, it is divided into sections by dams and sluices, and each section is kept at the water level of the boezem to which it belongs. Take the Oude Ryn, for example. That branch of the Rhine, having parted with the Vecht at Utrecht, crawled on to Leiden, and so to the North Sea at Katwyk. Centuries ago, however, it had become so decrepit that it had to stop far short of its destination at the coast; it sat down, as it were, in the middle of the Rhineland, and for some hundreds of years was an object of contempt and a nuisance to the whole countryside. At length under the direction of Louis Napoleon, early in this century, it was helped onto its feet again, and given a new set of crutches, and so partly lifted, partly shoved, into the sea at Katwyk.

The figure of beggarly decrepitude will not avail further; and it may as well be said that it is not a true figure according to everyone's reading of the evidence. Floods and drainage works, the forces of nature and the contrivances of men have within historical times completely altered the course and branches of the Rhine after its entry into Holland; that is undoubted, but precisely the changes that have been made are matters of dispute. Especially the course of the old Rhine, and whether (as my figure assumed) it ever had a mouth at Katwyk, are interesting and debatable questions. Here it is sufficient to understand that what has happened to this old Rhine is that it has ceased to be a river, practically, and is cut up into a series of basins, with dams and sluices, at varying water levels. So it is with other waters; they are subdivided into reservoirs. Lakes, where they exist, perform the same service. Now these boezems, again, communicate with the outer waters, or, if these are at a very much higher level, with higher boezems; so that, by a succession of steps, the superfluous waters of the lowest polders are brought to the outer waters at last. Finally, the country is protected from these outer waters by dikes, smaller or greater according to the volume and force of the outer waters; largest of all, of course, where the outer water is the driving ocean tides, at Den Helder or at West Capelle.

It is now clear why the waterstaat is so great and so characteristic a part of the Government of Holland. From very early times it has been recognized as an institution of the highest importance, requiring a separate administrative system. By the end of the eighty years' war, the country was broken up into waterschappen; an old house in Delft still exists as a memorial of the dike counts and their assessors of the Rhineland. Nowadays, each waterschap is governed by heemraden, who are elected by the proprietors of land within it. A hectare entitles to 1 vote, but no proprietor may exercise more votes than a fourth of the hectares on the waterschap. The heemraden conduct the business of the district from day to day, the matters of greater importance being dealt with by the proprietors (ingelanden) in council, or, in waterschappen of large extent, by their representatives (hoofd-ingelanden). The president of the heemraden, in the smaller districts, is nominated by the standing committee of the provincial states; in the larger, by the sovereign. The body has the power to levy the money required for the upkeep of works and for the general administration, and for making police regulations for the use and protection of the works, and for enforcing penal statutes.

From what we have seen of the system of draining, however, it will be evident that many of these sections of country form part of more than one waterschap. Thus a polder, or small waterschap, has its own administration, with its mills and canals, levying its own taxes; it pumps the water into canals, or other storage reservoirs, common to other polders, under the administration of a great waterschap, which levies rates against the upkeep of engines and sluices for carrying the waters to river or sea; while over all there is a heemraadschap, levying for its dikes against sea and river.

The powers given to these dike and polder governing bodies are very great. They are not confined to those of taxation and police regulation already referred to. Certain heemraadschappen have by ancient usage the right of digging out of the uiterwaarden the clay that is necessary for the building of the dikes. They can use the clay—that is to say, the best of the land—when they find it on the nearest spot and can take it with the least damage (te naaster lage en minster schade). This really is an ancient burden on all the uiterwaarden, dating from a time when the ground outside the dikes was of little worth. Now the value of these outer meadows is very great, and still the proprietor is indemnified for a small part only of his loss, although it seems likely that before long full compensation will be allowed. There are few things, indeed, that the governing bodies may not do if the doing of it seems necessary for protection from the waters. The country threatened by flood is in a state of siege. The dike governor issues his orders and they must be obeyed. In Holland no one can be dispossessed of property without a special act declaring the expropriation to be for the common weal and without the previous payment or the assurance of indemnity; but the constitution of which that is an article expressly excepts cases of war, fire, and watersnood—and watersnood comprises not only broken dikes and actual inundations but the imminence of these as well. Then the government of the dike or the polder can take possession of anything and can occupy any place as they think fit. They can call for any service they require. When the dike is threatened by a flood it

is protected by osiers placed upon its face. If the waters appear likely to mount over the dike, then the dike slopes are temporarily heightened by planks and the space on the top between the planks is filled up with anything that comes to hand. The polder proprietors have to supply laborers as in feudal days proprietors supplied soldiers; but others may be impressed for the work. Carts, wagons, wood, brick, manure—anything, in fact, that can be useful—may be appropriated without "by your leave" or more than the understanding that the value will be refunded. Houses can be demolished to supply stop-gap materials; houses have been demolished thus by dykgraven who still live to recount the urgency of the danger that required measures so heroic.

Something of the same necessary arbitrariness is to be seen in what is known as the "normaliseeren" of the rivers. Let me take by way of illustration our old friend the Lek, of whose turbulent doings the innkeeper and his wife at Maurik have told us. I have been fortunate in getting hold of a sectional plan of the scheme for normalizing that river some thirty years ago, and from a description of it possibly the reader will be able to gain a clear idea of the process. The section represents about three-quarters of a mile of the river considerably below Vianen. At this point the distance between the great north and south dikes varies from about 190 yards to 450 yards. In winter floods the water stretched from dike to dike. Nearer the channel are shown the smaller summer dikes that confine the river in summer, leaving the lands between the summer and winter dikes—the uiterwaarden—smiling to the sun, as the reader saw them in his first excursion into the Betuwe. Such was the varying bed of the Lek at this point. It has to be noticed that along the course of the summer dikes there are thrown out into the stream piers and jetties—kribben the Dutch call them, because they "crib" and confine the soil deposited by the river. Even the bed between the summer dikes varies greatly in extent; and thus the ordinary current of the river is irregular—fast in the narrower parts and slow in the wider. In the wider a large amount of sand is deposited, and the current is diminished still more. When kribben are constructed, however, the bed becomes narrower, and the current, digging out this narrow bed, deposits the sand between the kribben. After the space between them is filled up with the sand a layer of clay forms upon it, grass begins to spring up, and thus new land is added to the uiterwaarden. A glance at the chart, however, shows that the kribben are of two kinds. Some run out at an angle with the current, while others stand up to the current boldly. The first are not part of the scheme of normalizing. They have been made by the proprietors with a view to inclosure and are condemned as being unscientific in principle. It is no longer allowable to construct them.

All the kribben that are built now are of the other kind and run boldly out into the water. As has been explained, they are designed to bring the river into a normal channel lying between the two normalizing lines that we see indicated in the chart as running parallel to each other and touching the outjutting kribben on each bank. The river flows in this deepened channel, the evils of flood are mitigated, and it is found that the ice melts quickly in these deep waters in the center of the stream, and that the danger of an ysgang is lessened. That is the principle of normalizing the rivers, which the

observant traveler can see traces of in his railway journey over the Maas, the Waal, the Lek, between 's-Hertogenbosch and Utrecht, or indeed at almost any point where the train crosses a river. The arbitrariness with which it is applied is made plain in the chart. The normalizing lines are shown running through the uiterwaarden, and for the portions of land on the river side of these lines, which are broken away by the current, the proprietor gets small compensation. In the last revision of the constitution, in 1887, an article was inserted which seemed to hold out to the proprietor a promise of full indemnification against loss sustained in this manner. But as yet it has not been fulfilled. He is no longer allowed to build kribben and inclose at his discretion, and he has no claim upon the ground inclosed by the approved kribben unless he incurs the cost of constructing these. If, as generally happens, he declines that undertaking, the State builds them and becomes the possessor of the new uiterwaarden.

Now, it is in connection with this whole system of drainage for protection and reclamation that the provincial States play so important a part. All their other duties, as has been shown, are purely administrative, but the legislative powers placed in their hands in this exceptional case are very great indeed. They can form, unite, separate, the various waterschappen; they lay down the laws of their constitution; and the standing committee (gedeputeerde staten) have the permanent control of their administration.

It is evident that when there are so many bodies, all interdependent in view of a common danger, yet each of them representing separate interests, there must be frequent cases of diversity of opinion, of cross-purposes, and even of competitive action, calling for the exercise of this power of the provincial States. An action at law recently before the Dutch courts admirably illustrates this clashing of interests. It concerned the dikes upon the Lek, of which so much has been said already. The north dike, which protects a tract of country stretching to the gates of Amsterdam itself, had always been higher than the south dike that guards the Betuwe. It ought to be explained that neither dike really was as high as it ought to have been, else the relative measurements would not have mattered. As it was, the lower height of the south dike gave the country to the north comparative immunity, and in that selfish assurance the heemraadschap in the north were lulled into inaction. The direction of the south dike, however, was in very energetic hands, and one bad morning, when there were threats of inundation to rouse them, the north body wakened up to discover that the opposite dike was higher than their own. Immediately the cry was raised that Holland proper was in danger. A higher dike in the north was customary, and the customary, the heemraadschap contended, had passed into the right. They threw the onus of the present danger upon the shoulders of the heemraadschap in the south and of the government that had permitted them to heighten their dike. But the southern heemraadschap had a spirited answer. It was, they said, opposed to the root principle of the defense system to put limits to the energy and foresight with which a dike control protected a country under their guardianship, and they suggested that it was for the provincial States to step in and order a corresponding heightening of the dike on the north. This

was exactly the course the provincial States took; they gave instructions that the north dike was to be raised half a meter.

In the meantime, however, the heemraadschap on the north side had come to the conclusion that their dike must be heightened, and they had enlisted the assistance of the heemraadschappen of the districts in north and south Holland, which the danger threatened, in a scheme for raising it a meter. So the instructions of the provincial States were met by the request of the heemraadschap to be allowed to make the half meter a meter, and ultimately this was granted. And now arose the interesting questions that in time came before the courts for decision. For the addition to the dike, earth had to be abstracted from the uiterwaarden; were the proprietors to be indemnified against its loss? Then there was a difficulty about compensation for the trees upon the dike. It was contended by the heemraadschap that they ought not to have been there. The old practice of planting the Dutch dikes, with the idea of strengthening them thereby, had been condemned, and an order issued by the Government against the trees. The proprietors, however, chose to assume that in the absence of direct instructions the old trees upon a dike might be allowed to remain, and, remaining, they were on the Lek dike now to give rise to this litigation. Lastly, a change in the height of the dike involved a corresponding change in its slopes, and the consequent occupation of fresh land within the dike as well as without it; and here again was a ticklish point of indemnity to be settled. On all counts, I believe, the heemraadschap won the day, but that does not specially concern us. The whole history of the case is instructive as showing the nature of the questions that come before the provincial States for settlement.

Unlike the drainage works, the Dutch waterways have something to say for themselves. One might be standing in the middle of the Haarlemmer Meer, and have no reason to suspect that he was in a polder, or that he found a footing there only because somewhere or other enormous pumps were busy discharging thousands of tons of water from it. But it is impossible to sail along the North Holland Canal or the North Sea Canal without realizing some of the labor involved in its construction and upkeep.

The canals of Holland are innumerable. Broad and narrow, they flaunt like ribbons through the land. Here they are little dividing ditches, there the singels round the towns, again they are connecting chains between the great rivers. Sometimes, constructed for drainage, they become highways of traffic; at other times, they have been constructed as highways of traffic and are absorbed into the drainage system. Their involutions are bewildering. Between canals close-linked and canals flying loose ends, rivers canalized, rivers dammed, rivers given new mouths or lifted out to sea, we are befogged. He is not setting himself an easy task who would demonstrate how it is that the so-called Maas which flows past Rotterdam is in reality the Lek, and that not a drop of water from the Maas sources in the Ardennes falls into the sea by the Maas mouth at The Hook. As we go round Holland, we shall strike the main lines of the canal system, and be able possibly to clear up some of these mysteries. For our present purpose it is sufficient to visit the two great waterways from Amsterdam to the sea.

These waterways are the outcome of the needs of Amsterdam as a city of commerce. In earlier days and in earlier conditions of trading, she did not require them. Without any outlet to the ocean save the impracticable channel of the Zuider Zee (which is choked at the city mouth by the great sandbank, the Pampus, and is straight and dangerous at the other end, where it cuts off Texel from the mainland), she was in a state of splendid isolation that favored rather than retarded her commercial superiority. Sometimes the merchant ships came as far as the Pampus, whence their cargoes were carried to her in the scheepskameelen, or ships' camels, lighters specially constructed for that traffic; others, too large for the shallows of the Zuider Zee, lightened at Den Helder. The day arrived at length, however, when the necessity of an outlet to the sea became imperative if the capital was to hold her own, and in 1819 was begun, and five years later was finished, the North Holland Canal, with an exit at Nieuwe Diep.

It is interesting to notice that as far back as the middle of the seventeenth century, one Jan Pieterzoon Don had prepared plans for a canal across north Holland at its narrowest part, where the North Sea Canal now lies; though it ought to be observed that his object was not so much to provide communication with the ocean as to get rid of the inland sea of water which robbed the country of thousands of acres and threatened to rob it at any moment of many thousands more. A hundred years later an engineer of the waterstaat revived the project, and in the second decade of this century William I strongly advocated it. But in 1820 the country was no more ready for the undertaking than when Don planned it in 1634, and the canal that was determined upon was the North Holland Canal, issuing on the sea at Den Helder.

Even now, perhaps, that is the Dutch canal best known by the visitor to Holland. De Amicis says that it is nearly 50 miles in length and 43 yards in breadth, and estimates its cost at £1,250,000; and he speaks of it as one of the most wonderful works of the nineteenth century. Most of the notable descriptions of Holland, like that of De Amicis, have been written before the completion of the rival canal to Ymuiden; and, indeed, the winding course of the older waterway, by innumerable locks and under innumerable bridges, past Zaandam and Alkmaar, quaint and characteristic, and other show places, out to the sea at Nieuwe Diep, gives it a picturesqueness at least that can not be claimed for the shorter, straighter, more businesslike canal to Ymuiden.

For some fifty years this North Holland Canal was the only waterway for Amsterdam ships to the sea. But the locks at Den Helder, crowded and unrivaled thirty years ago, stand deserted now, eclipsed by the great works at Ymuiden. In one forenoon last spring when we sat beside them, delighting in the never-ending movement and play of color in the wharves at the Willemsoord, one vessel only, a small gunpowder boat for the forts, passed through the gates. The North Holland Canal, with its tortuous course and many locks and bridges, has outlived its usefulness; the very qualities that give it picturesqueness have made it unserviceable. It happened often that the great ocean ships were sighted from the heights at Velzerend days before they could enter at Den Helder; not infrequently, in tempestuous winters, weeks, months even, passed before they reached

Amsterdam. So in 1865 the Prince of Orange put the first spade in the sand at Ymuiden, where (as has been seen) it had been proposed to put it half a century earlier. The North Holland Canal was dead, the North Sea Canal was coming into existence.

The Haarlemmer Meer had been drained, but there still remained the gulf of the Zuider Zee, known as the "Y." It stretches south to Halfweg (on the present railway route from Amsterdam to Haarlem) and on the north to near Zaandam and westward to Beverwyk, at the foot of the North Sea dunes. To-day it is a polder; save for the canal and its branches, a stretch of fertile green. The inland sea has been drained; a canal has been run through it from Amsterdam to the coast at Ymuiden, and the reclaimed land of the Y-polders has been sold and has been occupied, as we have already heard. All's well that ends well. But that was an undertaking entered upon, and little wonder, with hesitation, and with opposition even. Timid citizens of Amsterdam, as they well might be, were fearful for their city and their province. Consider: To give exit to the canal the dunes had to be cut; the natural defenses of the country were to be deliberately broken down, and that at a point where the North Sea comes thundering upon them. Moreover, many interests were concerned, many interests clashed, and the cost was in proportion to the danger. In the end, however, all obstacles were overcome. For twenty years now the great ships have been passing to Amsterdam through that impoldered stretch.

As a picturesque route, as has been said, the North Sea Canal can not compare with the other, which meanders through north Holland northward to Nieuwe Diep. Its great points of interest are its locks. Those at the throat of the Zuider Zee, at Schellingwoude, over against Amsterdam, are three in number, conjointly named the Oranjesluizen, after the late Prince of Orange. At the same time as the Oranjesluizen, two locks were constructed at the North Sea end of the canal, at Ymuiden, but after a time they were found to be too small and work was begun upon other locks of greatly larger dimensions, which were finished and opened for traffic in 1897. I will ask the reader to join me in a visit, already referred to, which I paid to these locks in the summer of 1896.

Instead of making the railway journey all the way to Ymuiden, we alight at Velzen Junction and walk. By doing so, we come gradually and with better understanding upon the main works: First, a mushroom hamlet, not Dutch in character, but sprung out of the needs of the enterprise, and in its squalor and neglect, and curiously enough in its background setting also, reminding us of a familiar mining village in the east of Scotland. For the next few hundred yards, however, we are in Holland; the road is of clinkers; peasants in Dutch costume pass along it, and over the flat landscape to the right appear, now and then, a mast, a sail, a column of moving smoke—indications of a canal. Suddenly, at a bend of the road, the melting morning mists discover, pale but bright, the village of Ymuiden, with two tall light-houses rising apparently from its midst, and, beyond, the sea. On our right, as we walk along, are the works themselves—the branch canal to the new lock, dredgers vomiting forth yellow water at the tail of the bank, endless chains of buckets, cranes, sheds, lighters, steamers, groups of navvies; and all the while, on the main canal nearer us, the everyday traffic, and cutters and

fishing smacks skipping across the harbor beyond the locks. For a hundred yards or so the road becomes the main street of Ymuiden, and by a sharp turn at the farther end leads on to the quay. A Grimsby smack or two lie beside it, unloading for the auction proceeding, in Dutch fashion, close by. After a time spent in watching some vessels entering the old locks, we cross the canal to visit the new works. A courteous native of whom we make inquiries about them is eager to impart all the information he possesses, and insists upon being our guide. He is a fish buyer or a ship's chandler, a plain citizen at any rate, but in these last five years plain citizens of Ymuiden have become as voluble about hydromechanics as an engineer of the waterstaat. So we are piped on our way to the new locks to the tune of marvelous dimensions. From here to the east-dock locks at Amsterdam, it seems, is a distance of 15½ miles. Throughout that length, the canal has an ordinary water level of 1 foot 7 inches and a depth of 27 feet, below A. P., a bottom width of nearly 30 yards, and a width at water level varying from 60 to 120 yards. Then come figures to prove the superiority of the new locks over all the other locks in Holland, and from them I extract this comparative table, which contains all the information on the point that a reasonable man can desire:

| | Length. | Width. | Depth below A. P. |
|---|---|---|---|
| | *Feet.* | *Feet.* | *Feet.* |
| Main lock at Schellingwoude | 315 | 59 | 14½ |
| Old main lock at Ymuiden | 394 | 59 | 25 |
| New lock at Ymuiden | 735 | 82 | 33 |

Our guide follows up his figures with a boast. "The biggest steamer in Holland will be able to enter Amsterdam now," he declares, and I have a reason of my own for believing it. A Rotterdam man had been telling me of a large new steamer that was sailing out of the Maas, the largest vessel in the Dutch fleet. "Will it be able to sail from Amsterdam when the new North Sea locks are opened, do you think?" I asked him. "That," he replied, looking very grave, "is a doubtful question;" whereby I was convinced that the largest vessel in the Dutch fleet could sail from Amsterdam. A Rotterdammer does not give Amsterdam the benefit of a doubt.

But now there is no more need of the pæans of our guide, for we have crossed the island between the two channels, and can see for ourselves the new lock and all the marvel of its construction. It lies farther inland than the old locks, and about 70 yards from the old channel. That was as near as they could venture to bring it, in view of the dangers of ground water. The canal branches off to it at a point about a third of a mile to the eastward, and on the seaward side a channel has been dug to connect the harbor and the lock some 300 yards below the old sea gates. Water lies in the branch canal up to the inner sluice head, but the trough of the connecting channel is nearly dry, for the natural dam between it and the harbor will not be cut until all the other operations are finished. How shall I describe the lock itself, or rather the locks, for though there is only

one opening, there are two pits, a shorter and a longer, so that in the passage of smaller vessels as little sea water as possible may enter the canal? Imagine the Strand, a greatly widened Strand it must be, from Waterloo Bridge to the Adelphi, lined with unbroken walls of solid, beautifully finished masonry, where now are houses, and with gigantic gates at either end and somewhere about Southampton street between. Imagine, further, that the level of the housetops is the level of the surrounding country, and that you are standing there on the edge of the walls and looking down into the Strand. You will then have some idea of the appearance of the locks before the water had been admitted. Unfortunately, however, there is a little water in the locks covering the floors, and so even we at Ymuiden have to exercise our imaginations if we are to understand all the wonders of their construction. With our guide at our elbow and the Strand fancy in mind, however, it may not be difficult to realize some of them.

First of all, the pit in which the locks are situate had to be excavated, and I do not know that we get any clearer idea of the labor which that involved when we have learned that 50,000,000 cubic feet of sand were removed. There are other figures rather more informing. The original design was to make the thresholds of a depth of a little over 27 feet, 9 inches below A. P. Later they were planned for 3 feet deeper, and ultimately were brought to 32 feet, 9 inches below A. P. But this last addition of 2 feet cost close upon £30,000, and before it was sanctioned by ministers it had become "a great plot of state." The reader may be spared the consideration of the results of borings, experiments with ground water, and calculations as to the rise and fall of the tides, that determined the manner of constructing the thresholds. The pit kept dry, drier than had been expected, and the subsoil was firm. The chief concern, it seemed, was to offer a sufficient resistance to the high water outside the gates in its efforts to force a way within. To accomplish this, a floor 8 feet thick had to be laid of beton, a rough concrete composed of brick, sand, slacked lime, and tufa. To receive this beton, a framework—a wooden tub, as it were—was sunk round the bottom of the pit. It was fashioned of planks a foot wide and 8 inches thick, and no less than 26 feet long. This great length was necessary because, from the fear of water when they dug deeper, the engineers sunk the planks when the bottom of the pit was only 26 feet deep, and they had to allow them a hold sufficient to resist the outside pressure when the pit had been farther excavated to 32 or 33 feet. It can easily be understood that to drive home this framework was enormous labor. To overcome the great resistance at this depth, pipes, through which water was pressed, were inserted on each side of the plank so as to loosen the sand before it in its way down under the blows of the rammer. Moreover, since the framework had to be nearly as water-tight as it could be made, the planks were not merely driven into the soil, but were deeply grooved into one another. It gives us some idea of the quantity of materials used in this frame when we learn that the grooving of the planks necessitated an additional 14,000 cubic feet of wood and increased the cost by £1,000. Nearly 900,000 cubic feet of beton were swallowed up, and the cost of floor and frame together was £50,000.

We have had more than enough of figures, else we might go step by step through the different stages of construction and learn exactly how and at what a cost Holland's enemy was circumvented and subdued. There was a critical moment in the fight, when the water rushed from below through an old boring in one of the sluice heads, burst, and scattered aside the beton floor, and seemed to be about to demolish triumphantly the work and skill of years. It is an interesting story by what means, now hidden from sight, that assault was met, but we will not tell it. There is no need of hidden proofs of the ingenuity and daring of the engineers. The lock itself, just so much as we can see of it, without any explanations of guides or blue-books, proclaims their triumph loudly enough.

So we bid farewell to our guide and his miles of bewildering measurements still unrecited, and are ferried across the fisher harbor to the light-houses. After a blowy walk along one of the piers, which the harbor shoots like gigantic feelers into the North Sea, we return to the outer light-house and climb to the top. And now, far more vividly than in meters and kilometers and tons and cubic feet, we realize in a wide view all that we have been gazing at in detail. Here, unbroken, save where the harbor stretches a neck through them, are the dunes, from 60 to 80 feet high, that shelter the low-lying country from the ocean. But for them the whole country to the very gates of Amsterdam would be at the mercy of the sea. To pierce them, trusting to these fragile arms to keep back the enemy, is surely daring confidence in human skill. To-day the sea lies peacefully shimmering in the sunlight; but think of it, as we have seen it many a time, thundering hoarsely under a gray sky. And then the eye turns inland to the locks. Enormous locks and enormous gates, beautifully and ingeniously constructed, giants among engineering works, yet, after all, pigmies beside the ocean when the tide has risen 6 feet, say, above the normal water level of the Y at Amsterdam. We need no figures to persuade us of the wonders of that sight.

The whole story of the fight with the waters surely forces upon us the consideration that, howsoever brilliant and daring and successful it has been, if it had not an enduring and ennobling influence upon the national character, then it has been in vain. In itself, to pump water out of peat bogs and to keep them drained is not a high destiny, and in Holland it is not even a work that has repaid the cost. What, of itself, is another province of Zeeland gained? If there is no other result than that from all this expenditure of energies, it would have been better had William of Orange, as it is said he once contemplated, carried his people to a new home across the Atlantic and allowed the sea to find and to keep its level right up to the eastern sand hills. "Luctor et emergo" would be a poor motto for Holland if she had come out of the fight possessed of nothing more than a few thousand hectares of land. Our figures and our descriptions have failed of their purpose if they have not called up to the reader the picture of a whole nation going about their daily work peacefully below the level of the sea, secure in the constructive skill and patience and daring that have bridled its power and opposed a barrier to its inexorable assaults. No estimate of Holland and the Hollanders is complete that omits that pregnant consideration.

The following graphical tables,[a] marked "A," "B," "C," "D," exhibit fully the waterways of the Netherlands and navigation thereon in the year 1902.

The director of the commercial institutions at Amsterdam (directeur der handelsinrichtingen) has replied to questions, numbered as in the department circular, as follows:

1. The Government is improving the North Sea Canal, the municipality paying 10 per cent subsidy on the improvements in course of construction. The Government defrays the cost of these improvements from the yearly revenues.

The municipality provides for the improvement of the harbor and for its subsidy on account of the North Sea Canal by bonds issued for the purpose. The maintenance is defrayed from the annual budget.

(*c*) No harbor nor canal dues are levied on the North Sea Canal. The municipality levies harbor dues for partially meeting the expenses of interest and repayment of the capital for construction, and for the improvement of the harbor works, for keeping same in order and for the management.

The municipality has built the harbors and quays and transit sheds, and nowadays also the railways; the tanks of the municipal petroleum entrepot, and the tanks, warehouses, and railways of the municipal commercial entrepot.

Companies (Veems; see Special Consular Reports "Stored Goods as Collaterals for Loans," vol. 25) have built warehouses on the quays.

Some of the steam navigation companies have built sheds, and some tanks have been built in the petroleum harbor by the American Petroleum Company.

(*f*) The North Sea Canal and also the Rhine Canal (Merwede Canal) are free of tolls.

(*g*) Work on the canals is given out by contract by the Government, as also the works of the harbors by the municipality.

3. The navigable depth under normal canal conditions, 0.50 meter under A. P. (Amsterdam peil, or water level, which is the standard for the country) was 72 decimeters; in the new harbor it is 82 decimeters, and will be made later on the same as the North Sea Canal, 95 decimeters (10.30 meters bottom depth, A. P.).

4. Two hundred and twenty meters in length and 24 meters broad (lock at Ymuiden 225 meters long and 25 meters in breadth).

8*a*. For construction and improvement by the municipality, 25,000,000 florins ($10,050,000).

For the North Sea Canal, for harbor and for construction of railways at Amsterdam, and for construction and improvement of the Merwede Canal, 100,000,000 florins ($40,200,000), by the Government.

9. See Annual Report of Chamber of Commerce.

The chief engineer of the waterways at Amsterdam states:

1 (*a–e*). It may be stated generally that the entrances to the harbors and canals are or have been made, maintained, and improved by the Government, whereas the harbors and the harbor institutions in most cases have been made and are maintained by the municipalities.

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[a] The illustrations referred to in the above paragraph have not been reproduced as a part of this document.

Government harbors exist only at Delfzyl, Harlingen, Vlieland, Terschelling, Nieuwediep, Wieringen, Medemblik, Urk, Stavoren, Lemmer (harbor dams), Marken, Moerdyk, Willemstad, Breskens, the outer harbor of Scheveningue, the outer harbor of Ymuiden, and the fish harbor of Ymuiden.

Improvements on rivers and canals are made by private parties (waterschappen), principally for improvement of water delivery; the Oude Yssel, however, also for navigation; nearly all of them with subsidy of the Government (annually fixed).

The North Sea Canal has originally been built by the "Amsterdam Canal Company" (Amsterdamsche Kanaal Maatschappy); the canals in Overyssel, and the improvement between the rivers Schie and the Rhine, by the Province of South Holland.

(*f*) Dues on the government canals and harbors were abolished in the year 1900. On private canals and harbors a toll per ton is levied.

(*g*) Nearly all the works in the Netherlands are carried out by public or private bids offered by the Government, never by the Government itself; some municipalities under their own supervision.

2. See 1.

3, 4. See description navigable canals (also pp. 31 and 32 of "Memorial Book Royal Engineering Institution").

8 (*a*, *b*, *c*). See annual appropriation, and "Review of Memorial Book Royal Engineering Institution," page 274.

9. See "Statistics of Navigation on Canals and Rivers."

10. See description navigable canals.

The Dutch Railway Company, under date of July 29, 1903, has answered questions submitted as follows:

So far as we know, there are no existing statistics showing the entire amount of traffic by the inland waterways, and are unable to make comparisons between the traffic carried by railway and by waterway. However, we think the inclosed statement[a] may serve you, same stating the quantities of a number of important articles which have been imported into and exported from this country during the years 1897 1901, both on rivers and canals and by railway (this being for every one of the therein mentioned articles the total import and export, in so far as they did not enter by sea or country roads where there are no railways).

The figures appearing in the statement have been taken from the "Statistics of Import, Export, and Transit," which are annually published by the department of finance. We call attention to the fact that articles in transit are included both in the general imports and the general exports.

As for the greater part, most of the trade centers of this country are connected with the frontiers by both water and by railway, and in that connection it may be taken as a rule that articles imported by waterway are shipped through to destination by waterway, and that articles imported by railway are forwarded by railway.

Your suggestion suggests the remark that competition by waterways is becoming more and more intense of late, which is greatly to be ascribed to the use made of motor boats, which carry the goods quickly and cheaply.

[a] Marked "Exhibit A."

Too many fluctuations exist both in waterway and railway freights, therefore it is impossible to state the average freights for both means of transportation. We therefore considered it best to furnish you, as an example, a sample comparative statement of freights.

As far as it relates to railway freights, we stated the first-mentioned prices, even then when the prices of the general freight tariff are decreased through special prices, in order to show the decrease which the ordinary railway freights had to stand in consequence of competition by waterways.

A.—ROTTERDAM—AMSTERDAM.

I.—*By railway (73 kilometers).*

| | General class of bulky goods. | Special class of bulky goods. | Wagonload classes, prices per 1,000 kilograms (2,200 pounds). | | |
|---|---|---|---|---|---|
| | | | Class A—Goods not mentioned in the classification of the tariff. | Goods belonging to Classes B and C. | Goods belonging to Class C. |
| | Less than 5,000 kilograms (11,000 pounds) in one shipment, price per 100 kilograms (220 pounds). | | At least 5,000 kilograms (11,000 pounds) in one shipment. | | At least 10,000 kilograms (22,000 pounds) per car. |
| | *Florins.* | *Florins.* | *Florins.* | *Florins.* | *Florins.* |
| General tariff | [a] 0.34 ($0.14) | [a] 0.31 ($0.12½) | 2.60 ($1.04) | 2.30 ($0.92) | 1.80 ($0.72) |
| Special tariff for all goods | .20 (.08) | .20 (.08) | [a] 1.50 (.60) | [a] 1.50 (.60) | [a] 1.50 (.60) |

[a] Including expenses of loading and unloading.

Special tariff for grain imported by sea (by carloads of at least 10,000 kilograms (22,000 pounds), 1.20 florins ($0.48) per 1,000 kilograms (2,200 pounds).

II. *By freight steamer.*

Ordinary bulky goods, 0.15 florin ($0.06) per 100 kilos (220 pounds).

Light bulky goods, 0.20 florin ($0.08) to 0.25 florin ($0.10) per 100 kilos (220 pounds).

Large lots (including iron), 1.50 florins ($0.60) per 1,000 kilos (2,200 pounds). Receiving free for at least 10,000 kilos (22,000 pounds).

Coffee, tobacco, grain, 2 florins ($0.80) per 1,000 kilos (2,200 pounds). Receiving free for at least 10,000 kilos (22,000 pounds).

III. *By packet boat.*

General tariff: Up to 9,999 kilos (21,998 pounds), 0.31 florin ($0.12½) per 100 kilos (220 pounds), inclusive of receiving and delivering (the last only for lots of 2,000 kilos (4,400 pounds); from 10,000 kilos (22,000 pounds), 0.26 florin ($0.10) per 100 kilos (220 pounds), inclusive of receiving and delivering. By contract less.

IV. *By boatman.*

Oats, 0.92½ florin ($0.37) per 1,000 kilos (2,200 pounds), inclusive of receiving and delivering alongside of waterhouse, lots of 40,000 kilos (88,000 pounds).

Oats, 0.75 florin ($0.30) per 1,000 kilos (2,200 pounds), inclusive of receiving and delivering alongside of warehouse, lots of 100,000 kilos (220,000 pounds).

Tobacco and coffee, 0.75 florin ($0.30) per 1,000 kilos (2,200 pounds), inclusive of receiving and delivering alongside of warehouse, lots of 20,000 kilos (44,000 pounds).

Tobacco and coffee, 0.62½ florin ($0.25) per 1,000 kilos (2,200 pounds), inclusive of receiving and delivering alongside of warehouse, lots of 50,000 kilos (110,000 pounds).

B.—ROTTERDAM–APELDOORN.

I.—*By railway (117 kilometers).*

| | | | Wagonload classes, prices per 1,000 kilograms (2,200 pounds). | | |
|---|---|---|---|---|---|
| | General class of bulky goods. | Special class of bulky goods. | Class A goods not mentioned in the classification of the tariff. | Goods belonging to Classes B and C. | Goods belonging to Class C. |
| | Less than 5,000 kilograms (11,000 pounds) in one shipment, price per 100 kilograms (220 pounds). | | At least 5,000 kilograms (11,000 pounds) in one shipment. | | At least 10,000 kilograms (22,000 pounds) per car. |
| | *Florins.* | *Florins.* | *Florins.* | *Florins.* | *Florins.* |
| General tariff..... | [a] 0.48 ($0.19) | [a] 0.42 ($0.17) | 3.70 ($1.49) | 3.10 ($1.25) | 2.20 ($0.88) |

[a] Including expenses of loading and unloading.

Special tariff for coal, quantities of at least 10,000 kilograms (22,000 pounds) per car used, 1.73 florins ($0.69) per 1,000 kilograms (2,200 pounds).

Special tariff for grain imported by sea, quantities of at least 10,000 kilograms (22,000 pounds) per car used, 1.70 florins ($0.68) per 1,000 kilograms (2,200 pounds).

Special tariff for sewage, manure, street dust, and compost, quantities of at least 10,000 kilograms (22,000 pounds) per car used, 1.22½ florins ($0.49) per 1,000 kilograms (2,200 pounds).

II.—*By steamer.*

Small lots, 2 florins ($0.84) per 1,000 kilograms (2,200 pounds). Large lots, 1.50 florins ($0.63) per 1,000 kilograms (10,000 kilograms receiving free).

III.—*By boatman.*

Lots of 50,000 kilograms (110,000 pounds), 1.25 florins ($0.50) per 1,000 kilograms (2,200 pounds), inclusive of receiving and delivering alongside of warehouses.

C.—ROTTERDAM–NYMEGEN.

I.—*By railway (115 kilometers).*

| | | | Wagonload classes, prices per 1,000 kilograms (2,200 pounds). | | |
|---|---|---|---|---|---|
| | General class of bulky goods. | Special class of bulky goods. | Class A goods not mentioned in the classification of the tariff. | Goods belonging to Classes B and C. | Goods belonging to Class C. |
| | Less than 5,000 kilograms (11,000 pounds) in one shipment, price per 100 kilograms (220 pounds). | | At least 5,000 kilograms (11,000 pounds) in one shipment. | | At least 10,000 kilograms (22,000 pounds) per car. |
| | *Florins.* | *Florins.* | *Florins.* | *Florins.* | *Florins.* |
| General tariff..... | [a] 0.47 ($0.19) | [a] 0.41 ($0.16) | 3.70 ($1.49) | 3.10 ($1.25) | 2.20 ($0.88) |

[a] Including expenses of loading and unloading.

Special tariff for all kind of goods, at every quantity, 0.30 florin [a] ($0.13) per 100 kilos (220 pounds).

Special tariff for a number of goods, viz:

[Freight prices per 1,000 kilos (2,200 pounds).]

| | At least 5,000 kilos (11,000 pounds) each shipment. | At least 10,000 kilos (22,000 pounds) per car. |
|---|---|---|
| (a) Potatoes, cellulose, cement, grain; brass, lead, iron, tin, zinc, etc. | *Florins.* [a] 2.50 ($1.00½) | *Florins.* [a] 2.00 ($0.80½) |
| (b) Bear, butter, briquets, comestibles, drugs, eggs, coke, hay, wood, cattle cakes, coffee, oil, paper, petroleum, rice, straw, seeds, etc. | | [a] 2.50 ($1.00½) |

[a] Inclusive of loading and unloading expenses.

Special tariff for grain imported by seas, for carloads of at least 10,000 kilos (22,000), 1.60 florins ($0.64) per 1,000 kilos (2,200 pounds).

II.—*By steamer.*

Bulky goods, 0.12½ florin ($0.05) per 100 kilos (220 pounds).

Bulky goods (light; also oats), 0.20 florin ($0.08) per 100 kilos (220 pounds).

Large lots, 1.25 florins ($0.50) per 1,000 kilos (2,200 pounds), receiving of lots of 10,000 kilos (22,000 pounds) free of charge.

III. *By boatman.*

Lots of 50,000 kilograms (110,000 pounds), 1 florin ($0.40) per 1,000 kilograms (2,200 pounds), inclusive of receiving and delivering alongside of warehouse.

D.—ROTTERDAM-FLUSHING.

I.—*By railway (133 kilometers).*

| | | | Wagon-load classes, prices per 1,000 kilograms (2,200 pounds). | | |
|---|---|---|---|---|---|
| | General class of bulky goods. | Special class of bulky goods. | Class A.—Goods not mentioned in the classification of the tariff. | Goods belonging to classes B and C. | Goods belonging to class C. |
| | Less than 5,000 kilograms (11,000 pounds) in one shipment, price per 100 kilograms (220 pounds). | | At least 5,000 kilograms (11,000 pounds) in one shipment. | | At least 10,000 kilograms (220,000 pounds) per car. |
| General tariff | *Florins.* [a] 0.52 ($0.21) | *Florins.* [a] 0.46 ($0.18½) | *Florins.* 4.10 ($1.65) | *Florins.* 3.50 ($1.41) | *Florins.* 2.40 ($0.96½) |

[a] Inclusive of loading and unloading expenses.

II.—*By steamer.*

General tariff: Under 1,000 kilograms (2,200 pounds), 0.30 florin ($0.12) per 100 kilograms (220 pounds). From 1,000 kilograms (2,200 pounds) to 2,500 kilograms (5,500 pounds), 0.25 florin ($0.10) per 100 kilograms (220 pounds). From 2,500 kilograms (5,500 pounds) to 5,000 kilograms (11,000 pounds), 0.20 florin ($0.08) per 100 kilograms (220 pounds). Over 5,000 kilograms (11,000 pounds), 1.75 florins ($0.70) per 1,000 kilograms (2,200 pounds).

[a] Inclusive of loading and unloading expenses.

E.—FLOUR IN BAGS FROM AMSTERDAM TO LEEUWARDEN AND GRONINGEN.

[Lots of 10,000 kilograms (22,000 pounds). Prices per 1,000 kilograms (2,200 pounds).]

| From Amsterdam to— | Freight by water. | Kilometers. | Railway freight. | |
|---|---|---|---|---|
| | | | General tariff. | Special tariff. |
| | | | *Florins.* | *Florins.* |
| Leeuwarden | 1.50 to 2 florins ($0.60 to $0.80). | 137 | 2.40 ($0.96½) | |
| Groningen | | 195 | 3.00 ( 1.21 ) | 2.70 ($1.08½) |

F.—GRAIN FROM AMSTERDAM TO LEEUWARDEN AND GRONINGEN.

[Freight prices per 1,000 kilograms (2,200 pounds).]

| From Amsterdam to— | Lots of 50,000 to 60,000 kilograms (110,000 to 132,000 pounds). | | | Lots of 10,000 kilograms (22,000 pounds). | | |
|---|---|---|---|---|---|---|
| | Freight by water. | Railway freight. | | Freight by water. | Railway freight. | |
| | | General tariff. | Special tariff. | | General tariff. | Special tariff. |
| | *Florins.* | *Florins.* | *Florins.* | *Florins.* | *Florins.* | *Florins.* |
| Leeuwarden | 0.75 ($0.30) | 2.40 ($0.96½) | 2.20 ($0.88 ) | 1.25 ($0.50) | 2.40 ($0.96½) | 2.20 ($0.88 ) |
| Groningen | .80 ( .32) | 3.00 (1.21 ) | 2.40 ( .96½) | | 3.00 ( 1.21 ) | 2.40 ( .96½) |
| | .90 ( .36) | | | | | |

G.—ORE.

[Prices per 1,000 kilograms (2,200 pounds).]

| From Rotterdam to— | Freight by water for large lots. | Kilometers. | Railway freight for shipment consisting of one or more carloads of 10,000 kilograms (22,000 pounds). |
|---|---|---|---|
| | *Florins.* | | *Florins.* |
| Ruhrort, Germany | 0.50 ($0.20) | 209 | 3.00 ($1.21) |
| | .60 ( .24) | | |

Notwithstanding this difference in freight a large number of shipments of ore are made by railway. This has to be ascribed to the fact that the ore carried by water to Ruhrort has to be transshipped there by railway, in order to be carried to the industrial center of the Ruhrarea. Thereby a total freight is reached, which makes it possible for us to make contracts for carrying large lots by railway at prices competing with the freights by waterway.

H.—GRAIN.

[Prices per 1,000 kilograms (2,200 pounds).]

| From Rotterdam to— | Freight by water for large lots. | Kilometers. | Railway freight for shipment consisting of one or more carloads of 10,000 kilograms (22,000 pounds). |
|---|---|---|---|
| | *Florins.* | | *Florins.* |
| Dusseldorf, Germany | ±1 ($0.40) | 213 | 4.37 ($1.75) |
| Cologne, Germany | ±1.12½ ( .45) | 241 | 5.07 ( 2.04) |

Competition by railway is only possible for places not located near the waterways, or at an unfavorable water level.

Our country being provided with a very full web of canals, and all the rivers being navigable, not many new works are now carried out. However, lately there is a tendency to connect places, which up to the present have had no railway connections, to the large railway webs, by building local railways.

*General imports.*

| | 1897. | | 1898. | | 1899. | |
|---|---|---|---|---|---|---|
| | By rivers and canals. | By railways. | By rivers and canals. | By railways. | By rivers and canals. | By railways. |
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| Drugs, dyestuffs, and chemicals | 168,708 | 54,703 | 191,590 | 53,370 | 196,643 | 56,930 |
| Ore | 364,019 | 50,270 | 326,000 | 40,341 | 321,589 | 40,850 |
| Grain: | | | | | | |
| Wheat | 348,874 | 10,725 | 447,046 | 15,100 | 567,090 | 11,258 |
| Rye | 36,963 | 12,764 | 66,459 | 13,183 | 22,593 | 13,929 |
| Barley | 88,658 | 6,502 | 96,961 | 5,831 | 82,676 | 4,120 |
| Maize | 159,884 | 11,537 | 169,464 | 7,545 | 186,823 | 7,632 |
| Oats | 76,640 | 3,409 | 77,859 | 2,954 | 46,302 | 2,490 |
| Lumber (ship timber) | 103,337 | 27,909 | 99,790 | 27,923 | 104,853 | 30,675 |
| Hides, skins, and leather | 5,873 | 18,067 | 8,297 | 15,071 | 9,537 | 16,718 |
| Lime | 41,839 | 108,624 | 44,282 | 111,152 | 42,633 | 123,190 |
| Cotton | 15,938 | 24,950 | 18,230 | 28,828 | 17,621 | 24,802 |
| Manure | 179,022 | 114,958 | 204,268 | 131,192 | 162,906 | 133,909 |
| Metal | 196,790 | 279,044 | 224,504 | 314,565 | 226,086 | 325,625 |
| Metal wares | 177,162 | 224,935 | 192,363 | 192,562 | 191,211 | 220,967 |
| Stone | 1,171,340 | 203,440 | 1,575,007 | 227,759 | 1,381,902 | 274,093 |
| Coal | 2,007,646 | 3,172,324 | 2,234,691 | 3,397,198 | 2,163,191 | 3,351,558 |
| Seeds | 82,312 | 3,359 | 142,707 | 3,726 | 138,847 | 4,527 |
| Total | 5,225,005 | 4,327,520 | 6,119,518 | 4,588,410 | 5,862,503 | 4,643,273 |

| | 1900. | | 1901. | |
|---|---|---|---|---|
| | By rivers and canals. | By railways. | By rivers and canals. | By railways. |
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| Drugs, dyestuffs, and chemicals | 208,297 | 58,786 | 220,640 | 74,292 |
| Ore | 360,713 | 41,011 | 360,995 | 22,611 |
| Grain: | | | | |
| Wheat | 356,498 | 12,828 | 529,922 | 18,322 |
| Rye | 20,556 | 11,410 | 35,846 | 15,181 |
| Barley | 54,161 | 3,421 | 63,869 | 4,149 |
| Maize | 185,192 | 11,265 | 114,107 | 8,677 |
| Oats | 34,076 | 3,489 | 31,087 | 3,533 |
| Lumber (ship timber) | 119,017 | 41,222 | 93,497 | 39,529 |
| Hides, skins, and leather | 8,502 | 15,286 | 10,210 | 16,901 |
| Lime | 52,597 | 116,544 | 56,903 | 124,781 |
| Cotton | 12,120 | 32,846 | 14,941 | 32,811 |
| Manure | 158,472 | 137,745 | 141,711 | 157,036 |
| Metal | 203,792 | 313,431 | 358,571 | 487,276 |
| Metal wares | 198,114 | 212,350 | 273,934 | 270,456 |
| Stone | 1,591,392 | 278,754 | 1,567,792 | 298,860 |
| Coal | 2,305,540 | 3,471,438 | 2,421,813 | 3,506,724 |
| Seeds | 89,201 | 6,136 | 126,120 | 6,873 |
| Total | 5,958,240 | 4,767,962 | 6,421,958 | 5,088,012 |

*General exports.*

| | 1897. | | 1898. | | 1899. | |
|---|---|---|---|---|---|---|
| | By rivers and canals. | By railways. | By rivers and canals. | By railways. | By rivers and canals. | By railways. |
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| Drugs, dyestuffs, and chemicals | 188,383 | 48,759 | 222,048 | 35,591 | 218,043 | 52,280 |
| Ore | 2,453,234 | 476,685 | 2,793,025 | 471,430 | 3,313,057 | 574,788 |
| Grain: | | | | | | |
| Wheat | 1,154,049 | 10,560 | 1,182,847 | 10,622 | 1,202,111 | 5,854 |
| Rye | 334,335 | 4,429 | 328,642 | 4,248 | 247,300 | 2,121 |
| Barley | 284,477 | 8,228 | 317,000 | 7,804 | 289,994 | 8,801 |
| Maize | 266,074 | 6,770 | 381,039 | 7,362 | 410,306 | 5,786 |
| Oats | 310,570 | 3,539 | 264,991 | 3,210 | 275,458 | 2,642 |
| Lumber (ship timber) | 661,922 | 137,800 | 774,689 | 140,367 | 718,511 | 153,653 |
| Hides, skins, and leather | 9,323 | 18,905 | 11,172 | 15,067 | 9,370 | 14,912 |
| Cheese | 2,419 | 11,341 | 2,389 | 13,122 | 2,770 | 14,360 |
| Cotton | 22,186 | 20,230 | 21,015 | 25,803 | 23,240 | 27,738 |
| Manure | 176,739 | 48,310 | 200,469 | 48,917 | 216,219 | 51,887 |
| Metal | 386,428 | 234,012 | 352,568 | 228,779 | 500,756 | 265,798 |
| Metal wares | 73,867 | 79,316 | 85,837 | 55,904 | 88,465 | 65,166 |
| Stone | 152,923 | 25,036 | 221,276 | 28,683 | 252,780 | 32,692 |
| Coal | 781,116 | 499,581 | 955,704 | 567,333 | 1,226,463 | 659,323 |
| Tobacco and cigars | 15,729 | 17,262 | 16,680 | 18,802 | 16,308 | 17,254 |
| Cattle food | 79,229 | 57,308 | 104,557 | 57,226 | 85,367 | 62,391 |
| Seeds | 190,530 | 24,077 | 192,783 | 32,939 | 196,280 | 33,637 |
| Total | 7,543,533 | 1,732,148 | 8,428,731 | 1,773,209 | 9,292,798 | 2,051,083 |

| | 1900. | | 1901. | |
|---|---|---|---|---|
| | By rivers and canals. | By railways. | By rivers and canals. | By railways. |
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| Drugs, dyestuffs, and chemicals | 236,116 | 49,255 | 218,665 | 56,557 |
| Ore | 3,403,343 | 506,061 | 3,733,752 | 609,418 |
| Grain: | | | | |
| Wheat | 1,050,935 | 5,450 | 1,478,170 | 5,753 |
| Rye | 326,475 | 3,399 | 286,376 | 3,728 |
| Barley | 211,843 | 7,602 | 237,003 | 7,387 |
| Maize | 286,197 | 7,362 | 209,940 | 9,223 |
| Oats | 335,149 | 3,938 | 297,089 | 3,105 |
| Lumber (ship timber) | 753,772 | 138,364 | 721,575 | 132,309 |
| Hides, skins, and leather | 9,161 | 14,667 | 10,097 | 14,209 |
| Cheese | 2,530 | 14,968 | 2,968 | 14,332 |
| Cotton | 15,164 | 27,578 | 18,663 | 25,348 |
| Manure | 149,770 | 38,283 | 175,533 | 39,954 |
| Metal | 609,735 | 323,757 | 319,048 | 330,589 |
| Metal wares | 81,396 | 61,883 | 130,062 | 80,393 |
| Stone | 335,900 | 29,516 | 297,547 | 26,750 |
| Coal | 1,712,819 | 782,681 | 1,201,840 | 662,656 |
| Tobacco and cigars | 18,392 | 18,033 | 16,221 | 19,358 |
| Cattle food | 81,919 | 69,714 | 72,136 | 105,320 |
| Seeds | 186,504 | 32,860 | 196,117 | 29,088 |
| Total | 9,807,120 | 2,135,371 | 9,622,802 | 2,175,477 |

From the act making appropriation for the improvement, maintenance, and repairs of rivers and canals for the year 1903 the following is abstracted and translated:

| | Florins. | United States equivalent. |
|---|---|---|
| Improvement of the rivers the Rhine and the Lek | 173,400 | $69,706.80 |
| Improvement of the river the Waal | 276,300 | 111,072.60 |
| Improvement of the river the Yssel | 97,500 | 39,195.00 |
| Improvement of the Merwede River and the Killen | 127,000 | 51,054.00 |
| Improvement of the Dordrecht waterways | 68,900 | 27,697.80 |
| Improvement of the Holland Diep and Haringvliet | 770,000 | 30,954.00 |
| Improvement of the Maas River in Limburg, North Brabant, and Gelderland | 228,300 | 91,776.60 |

| | Florins. | United States equivalent. |
|---|---|---|
| Improvement of the mouth of the Maas River | 185,000 | $74,370.00 |
| Maintenance and repairing the mouth of the Maas River and the Donge | 125,500 | 50,451.00 |
| Maintenance of the Dintel River near Dinteloord | 68,300 | 27,456.60 |
| Maintenance, repairing of the improvement of the works of the waterway from Rotterdam to sea along the New Maas, the Scheur, and the Hook of Holland | 513,000 | 206,226.00 |
| Maintenance, repairing, and improvement of the works of the Holland Yssel | 16,550 | 6,653.10 |
| Maintenance, repairing, and improvement of the Lingeworks | 2,500 | 1,005.00 |
| Maintenance, repairing, and improvement of the Zwarte water | 4,200 | 1,688.40 |
| Maintenance, repairing, and improvement of the Zwolle diep | 24,000 | 9,648.00 |
| Maintenance, repairing, and improvement of the Vecht River in Overyssel | 300,000 | 120,600.00 |
| Maintenance, repairing, and improvement of the works of the inner and outer Aa in Groningen | 1,800 | 723.60 |
| Maintenance, repairing, and improvement of sea and port works, ports of Hellevoetsluis, Goedereede, etc | 35,000 | 14,070.00 |
| Maintenance, repairing, and improvement of sea and port works, ports of Vlieland, Urk, and Marken | 330,000 | 132,660.00 |
| Providing for the defense of the North Sea coast in the province of North Holland | 30,000 | 12,060.00 |
| Maintenance, repairing, and improvement of sea and port works, ports of Veere, Flushing, and Brouwershaven, etc | 56,500 | 22,713.00 |
| Maintenance, repairing, and improvement of sea and port works, Ameland, Schiermonnikoog Nieuwezylen, etc | 34,500 | 13,869.00 |
| Maintenance, repairing, and improvement of sea and port works in the province of Overyssel | 23,000 | 9,246.00 |
| Maintenance, repairing, and improvement of sea and port works in the province of Groningen | 6,100 | 2,452.20 |
| Subsidy for the deficit of expenses for coast works, province of Zeeland | 150,000 | 60,300.00 |
| Destroying wrecks and their cargoes | 30,000 | 12,060.00 |
| Maintenance, repairing, and improvement of the harbors and their entrances of Moerdyk and Willemstad | 10,000 | 4,020.00 |
| Building an outer harbor as entrance to the fishermen harbor of Scheveningue | 125,000 | 50,250.00 |
| Maintenance, repairing, and improvement of harbors in the province of North Holland | 81,950 | 32,943.90 |
| Maintenance, repairing, and improvement of harbors in the province of Zeeland | 23,600 | 9,487.20 |
| Maintenance, repairing, and improvement of the harbors of Harlingen and Makkum, province of Friesland | 55,000 | 22,110.00 |
| Maintenance, repairing, and improvement of harbors, province of Overyssel | 3,500 | 1,407.00 |
| Maintenance, repairing, and improvement of harbors, province of Groningen | 313,000 | 125,826.00 |
| Maintenance, repairing, and improvement of Merwede canal and Zederik canal | 375,500 | 150,951.00 |
| Maintenance, repairing, and improvement of Zuidwillemsvaart | 133,000 | 53,466.00 |
| Maintenance, repairing, and improvement of Dieze Canal | 12,000 | 4,824.00 |
| Maintenance, repairing, and improvement of Yssel Canal | 19,000 | 7,638.00 |
| Maintenance, repairing, and improvement of Voorne Canal | 40,000 | 16,080.00 |
| Maintenance, repairing, and improvement of locks and bridges waterway from Amsterdam to Rotterdam | 6,000 | 2,412.00 |
| Maintenance, repairing, and improvement of the North Holland Canal | 131,000 | 52,662.00 |
| Maintenance, repairing, and improvement of the canal from Amsterdam to the North Sea | 565,000 | 227,130.00 |
| Improvement of the North Sea Canal | 700,000 | 281,400.00 |
| Maintenance, repairing, improvement, and exploitation of the fishing harbor of Ymuiden | 223,200 | 89,726.40 |
| Maintenance, repairing, and improvement of the canal from Amsterdam to Vreeswyk | 12,500 | 5,025.00 |
| Maintenance, repairing, and improvement of the Terneuzen Canal | 59,000 | 23,718.00 |
| Improvement of the canal from Ghent to Terneuzen, as per agreement with Belgium | 2,500,000 | 1,005,000.00 |
| Improvement, repairing, and maintenance of canal through South Beveland | 84,000 | 33,768.00 |
| Improvement, repairing, and maintenance of canal through Walcheren | 960,000 | 38,592.00 |
| Improvement, repairing, and maintenance of canals in the Province of Groningen | 7,500 | 3,015.00 |
| Maintenance and exploitation of steam engines of the North Willem Canal | 14,600 | 5,869.20 |
| Maintenance, repairing, and improvement of the canal Meppelerdiep | 28,000 | 11,256.00 |
| Maintenance, repairing, and improvement of the Willems Canal in the Province of Overyssel | 16,500 | 6,633.00 |
| Maintenance, repairing, and improvements of the Veenhuizen Canal | 6,200 | 2,492.40 |
| Maintenance, repairing, and improvement of the main canals and Beiler Canal in the province of Drenthe | 122,500 | 49,245.00 |
| Maintenance, repairing, and improvement of the northern canal in the province of Limburg and the side canal to the Maas River, between Neer and Kessel | 11,000 | 4,422.00 |
| | 8,759,400 | 3,521,278.80 |

RAILWAYS.

| | Florins. | United States equivalent. |
|---|---|---|
| Bridge across the River Yssel near Westervoort | 252,000 | 101,304.00 |
| Extension of the railway depot at Hengelo | 174,000 | 69,948.00 |
| Renewing the western railway viaduct at Amsterdam | 30,000 | 12,060.00 |
| Railway depot of the state railway from Amersfoort to Nymegen at Amersfoort | 70,000 | 28,140.00 |
| Building and maintaining a harbor at Numansdorp in connection with the steam tramway, South Beyerland-Rotterdam | 12,000 | 4,824.00 |
| Building and maintaining a harbor on the Zype in connection with the steam tramway from Zype to Brouwershaven and from Willemspolder to Steenbergen | 45,000 | 18,090.00 |
| Works for steam tramways | 520,000 | 209,040.00 |
| | 1,103,000 | 443,406.00 |

The foregoing replies, it is believed, cover most points embraced in the interrogatories of the chairman of the Committee on Rivers and Harbors of the House of Representatives. The excerpt from the report of the Chamber of Commerce of Rotterdam for the year 1899, which follows, besides containing valuable figures as to the growth and relative present importance of several north European competing ports, seems to throw some light also upon the pressure exerted upon the railway systems by the waterways, and particularly the Rhine.

Special attention is called to the marked passages respecting the increase in the number of seagoing steamers plying up the Rhine as far as Cologne, the introduction of seagoing lighters, the apprehension which the rise of Emden as a port excites, the relation between river and inland and seagoing vessels and the Rhine navigation, water levels, and traffic in general.

RHINE NAVIGATION.

(Excerpts from the report of the Chamber of Commerce of Rotterdam for the year 1899; received from the United States consul at Amsterdam in his report on river and harbor improvements in the Netherlands, made in 1903.)

The harbor dues having been levied ever since 1886 on the gross tonnage, as already stated, we must take a comparative figure for Amsterdam and have therefore accepted, according to the annual reports of the chamber of commerce there, that the gross tonnage divided by 1.375 will give the net capacity, thereby reducing 2.83 cubic meters = 1 ton net.

In this way we get—

1899:

6,966,000 cubic meters gross = 1,812,500 tons net.

1898:

6,060,000 cubic meters gross = 1,557,365 tons net.

* * * * * * *

There is another matter to which we wish to call attention. The last ten years we have noticed a considerable increase in the number of seagoing steamers sailing up the Rhine as far as Cologne. The attempt was first made with a line from Cologne to London; others freighted vessels to the German North Sea and Baltic, and of late also to Russian ports.

Though the first attempts were generally looked upon with distrust, the results to which several of the lines are able to point justify the presumption that we shall have to reckon here with a constant factor, albeit low-water levels on the Rhine will often exercise a disturbing influence.

Together with these Rhine sea steamers, seagoing lighters have of late years entered the arena as competitors, most of them being timber laden and taking in return cargoes on the Rhine for the Baltic ports. The voyage is further performed with the assistance of tugs.

* * * * * * *

In judging of the future of Rotterdam, the question has also to be faced whether serious danger awaits our port from the rise of the German harbor of Emden. We are inclined to give a negative reply.

The Dortmund-Ems Canal, which connects the former place with Emden, seems to us, owing to its dimensions and the number of its sluices, not to give sufficient grounds on which to base expectations of a traffic of any great importance. Unless we be mistaken, they have come to the same conclusion in Germany too, and other attempts are being made, as they express it in some quarters, to become independent of foreign ports by the transmission of goods via Emden.

Commerce, however, usually entertains cosmopolitan ideas, and with this striving to artificially lead the traffic over German harbors stands out in strong contrast the fact that more and more do German lines cast their eyes on Rotterdam.

Thus last year the Hamburg-American Line opened its cargo service Rotterdam-East Asia, which example will soon be followed by the great mail steamers of the North German Lloyd.

If, however, serious attempts were really made and artificial means adopted to draw goods to Emden that now find their way over Rotterdam, it could not be done without serious injury to the Rhine havens, which now already are raising their voice and protesting that if favorable tariffs are granted to Emden, as a sea haven, they also claim the same privileges, since sea vessels steam right up to Cologne.

We will not, however, deny that Emden harbor is susceptible of improvement, but its development need not go along with retrogression and decline elsewhere, but can be the outcome of a general increase of commercial intercourse.

One thing that has of late years most forcibly contributed to the increase of traffic via Rotterdam is, we may be sure, the certainty of finding here the means of sending the goods farther on; Rotterdam has increased in multiplicity and variety of lines. While formerly much was imported via English or neighboring continental ports, we have now not only a system of direct imports instead, but besides that goods are dispatched via Rotterdam to their final destination much more than was formerly the case.

There is still a wide field open in this direction. Where other towns are not idle we shall do well to continue to work in good earnest for the extension of our splendid haven system, commercial emplacements, and other shipping facilities. It will also be our duty to guard against an undue driving up of the local shipping expenses and

to promote good labor relations, so that we may be enabled in every respect to go on vigorously competing with the best.

If the general welfare and the development of industry follow the course of the last few years we think we are certainly justified in expecting that our port will enjoy its full share of the fruits thereof.

In reference to the tables we shall give of the inland navigation we must remind our readers that for each stay of 17 days or less, the harbor dues may be capitalized for the whole year by payment of a lump sum for steamers of 40 times, and for other craft of 20 times the ordinary dues of 2 cents per cubic meter. Vessels under 10 cubic meters pay only 10 cents each voyage, or 1 florin down for the whole year.

For river and inland craft harbor dues were paid by:

| | 1899. | | 1898. | |
|---|---|---|---|---|
| | Number. | Measuring— | Number. | Measuring— |
| | | *Cu. meters.* | | *Cu. meters.* |
| Vessels paying by the voyage: | | | | |
| Steamers | 5,453 | 976,271 | 5,213 | 1,001,856 |
| Craft under 10 cubic meters | 1,327 | 7,886 | 1,434 | 8,683 |
| Sailing vessels of 10 cubic meters and higher | 53,106 | 11,040,744 | 53,184 | 10,082,829 |
| Vessels paying by the year | 390 | 37,030 | 483 | 35,589 |
| Vessels under 10 cubic meters | 825 | 3,249 | 849 | 3,371 |
| Sailing vessels, etc | 916 | 47,140 | 918 | 46,613 |

So, in the aggregate, harbor dues were paid for vessels paying by the voyage, in 1898, 59,831, measuring 11,093,368 cubic meters; in 1899, 59,886, measuring 12,024,901 cubic meters; in 1899, 55 more ships, measuring 931,533 cubic meters more; and by vessels, paying by the year, in 1898, 2,150, measuring 85,573 cubic meters; in 1899, 2,131, measuring 87,419 cubic meters; in 1899, 19 fewer ships, measuring 1,846 cubic meters more.

It may be taken for granted that of the ships paying by the year the steamers make at least 40 and the other vessels at least 20 voyages annually or there would be no inducement for them to subscribe. To find, therefore, the number of vessels that visited Rotterdam, we multiply, for the former, the number and the capacity by 40; for the latter, by 20, omitting altogether those under 10 cubic meters.

We then come to the following results, with which we compare the figures for 1898, obtained by the same calculation:

| | 1898. | | 1899. | |
|---|---|---|---|---|
| | Ships. | Cubic meters. | Ships. | Cubic meters. |
| River and inland craft | 93,028 | 14,548,145 | 92,697 | 13,550,847 |
| Seagoing vessels | 6,890 | 17,996,884 | 6,373 | 16,276,443 |
| Total | 99,918 | 32,544,989 | 99,070 | 29,827,290 |

The ratio between river and inland vessels and seagoing vessels was thus, according to the number:

| | 1898. | 1899. | 1898. | 1899. |
|---|---|---|---|---|
| | *Per cent.* | *Per cent.* | *Per cent.* | *Per cent.* |
| River and inland craft | 93.6 | 93.1 | 44 | 44.6 |
| Seagoing vessels | 6.4 | 6.9 | 56 | 55.4 |
| Total | 100 | 100 | 100 | 100 |

We here give the number of vessels that passed the principal bridges of our town in 1899:

*Number of vessels that passed Koninginnebrug.*

| | |
|---|---|
| Koninginnebrug (Queen's Bridge): | |
| Iron Rhine vessels, unloaded | 8,086 |
| Iron Rhine vessels, loaded | 8,124 |
| Wooden Rhine vessels, unloaded | 555 |
| Wooden Rhine vessels, loaded | 1,100 |
| Inland craft, not steamers | 28,766 |
| Inland steamers | 35,337 |
| Seagoing vessels | 79 |
| Seagoing steamers | 1,084 |
| Men-of-war | 40 |
| Total | 83,171 |

against 87,139 in 1898, 83,293 in 1897, 84,506 in 1896, and 71,526 in 1895.

Of these the following numbers were towed gratuitously by the city tugs:

| | |
|---|---|
| Inland craft | 19,741 |
| Rhine vessels | 1,622 |
| Total | 21,363 |

against 24,214 in 1898, 22,225 in 1897, 26,594 in 1896, and 24,278 in 1895.

*Number of vessels that passed Koningsbrug.*

| | |
|---|---|
| Koningsbrug (King's Bridge): | |
| 50 cubic meters and lower | 8,672 |
| 51 to 75 cubic meters | 6,666 |
| 76 to 100 cubic meters | 4,044 |
| 101 to 150 cubic meters | 4,010 |
| 151 to 200 cubic meters | 900 |
| 201 to 250 cubic meters | 257 |
| Above 250 cubic meters | 499 |
| Total | 25,048 |

against 24,975 in 1898, 24,752 in 1897, 24,115 in 1896, and 22,415 in 1895.

*Number of vessels that passed New Leuvebrug.*

| | |
|---|---|
| 50 cubic meters and lower | 6,112 |
| 51 to 75 cubic meters | 2,735 |
| 76 to 100 cubic meters | 2,019 |
| 101 to 150 cubic meters | 3,817 |
| 151 to 200 cubic meters | 2,164 |
| 201 to 250 cubic meters | 738 |
| Above 250 cubic meters | 3,424 |
| Seagoing vessels above 453 to 793 cubic meters | 18 |
| Total | 21,027 |

* * * * * * *

Before giving our usual statistics of the navigation of the Rhine we append a view of the condition of the fairway of our line of communication with Germany, with which we have been favored by the state engineers of the waterways stationed at Nimeguen and Dordrecht.

*Water levels.*—The year 1898 was characterized, in general, by very low water levels. Only at the commencement of the year was there a short period of high water. After the very prolonged low-water period toward the end of 1898 the rising set in exactly on the 1st of January, when the highest point reached, also the highest for the whole year, was 6.52 meters above zero on the 19th and 20th of January.

The upper river then immediately began to fall, and with the exception of a short period of somewhat higher levels continued to subside in the course of February up to April 4, when the water level at Cologne had fallen to 1.08 meters above zero, or 0.42 meter lower than the normal low-water mark. During the growth that thereupon took place the level rose to 4.60 meters above zero at Cologne on April 15, after which the waters, with a few unimportant fluctuations, went on subsiding up to the end of December.

The lowest grade of the scale at Cologne, with the river open, was attained on December 4, 5, and 6, and was 0.65 meter above zero, or only 0.03 higher than the lowest recorded level, with open river, from October 4 and 5, 1895.

When, shortly after, drift ice made its appearance on the river, the water subsided still farther, even to 0.45 meter above zero at Cologne on December 20. The thaw that set in soon after caused the river to swell toward the close of the year.

The highest point reached on the upper Rhine was read at Emmerich on January 21.

The lowest reading on the upper Rhine at Emmerich was on December 19.

On the Waal the lowest level, with open river, at Nimeguen was on December 5 and 6, and during the presence of drift ice in the river on December 20.

Of the prohibition marks for steam navigation only mark I at Nimeguen was overpassed from January 19 to 25; that is, seven days. The prohibition marks II and III were not attained.

In pursuance of section 22 of the police regulations for ship and raft navigation on the Rhine, including the Waal and the Leck, confirmed by royal decree of October 9, 1897 (State Calendar of Laws No. 204), rafting on the Waal was forbidden from January 17 to 25, viz, during nine days.

No impediments to navigation on the upper Rhine were experienced from the prolonged low-water level in the months of March and April, November, and December, nor were there any considerable hindrances on the Waal caused thereby.

At several sections of the river it was temporarily necessary to establish the usual police surveillance to ensure an uninterrupted passage.

Drift ice appeared on the Upper Rhine at Lobith from December 13 to 28 included; on the Waal at Nimeguen from 13 to 26 included; at Tiel from 13 to 27 included, at Zalt-Bommel from December 13 up to 23 included.

*Upper Rhine.*—For the rectification of the Upper Rhine, immediately above the separation point, tenders were asked and a contract signed for the prolongation of 2 cribs at the right bank under Hermen and Aerdt, and of 1 crib at the left bank under Millingen, as also the construction of 10 cribs, one of which arranged as a place for loading and unloading; all in the last commune between the kilometer posts VII and X of the revised river chart.

This work was not yet completed at the end of the year.

The condition of the river channel remained favorable and its direction showed no variation.

During the lowest water level, with open river, on December 6, 0.65 meter under normal low water, the least fairway depth, which was found near kilometer post O on the Upper Spyk still gauged 2.70 meters or 3.35 meters at ordinary low water.

Compared with the situation in 1898, when the least channel depth was 3.63 meters at ordinary low water, at this river section there has been a decline of 0.28 meter, which most likely will be only of a temporary nature.

The dredging work mentioned in our Review of 1898 between the principal dam at Pannerden and Loevestein was completed in the month of March.

The total quantity dredged amounted to 464,000 cubic meters as measured at the dumping ground of which—

| | Cubic meters. |
|---|---|
| Between kilometer posts XLVIII and L | 41,810 |
| Between kilometer posts L and LII | 19,446 |
| Between kilometer posts LV and LVI | 33,722 |
| Between kilometer posts LVII and LIX | 18,751 |
| Between kilometer posts LXVII and LXVIII | 72,220 |
| Between kilometer posts LXXXVI and LXXXIX | 213,341 |
| Between kilometer posts XC and XCI | 49,450 |
| Along the landing places at Vuren | 13,270 |
| From Veerhaven at Gameren | 1,990 |
| Total | 464,000 |

In May a contract was signed for the execution of dredging work between the principal dam at Pannerden and Loevestein, viz, between the kilometer posts X and XCIV, amounting to a minimum of 350,000 and a maximum of 500,000 cubic meters to a depth of 3.30 meters under ordinary low-water mark. This work was delivered complete after dredging 439,830 cubic meters, as measured at the dumping ground—

| | Cubic meters. |
|---|---|
| Between kilometer posts XXI and XXIV | 132,886 |
| Between kilometer posts XL and XLVI | 43,655 |
| Between kilometer posts XLV and XLVII | 61,196 |
| Between kilometer posts LI and LII | 57,462 |
| Between kilometer posts LXIV and LXV | 143,131 |
| From Veerhaven at Tuil | 1,500 |
| Total | 439,830 |

In June a contract was given for the construction of ground cribs between Ochten and Rosum, viz, between kilometer posts 2, XLVIII, and LXVIII.

With the quantities prescribed in the specifications, four ground cribs were laid at the left bank under Druten between kilometer posts XLVIII and L, four ground cribs at the right bank under Echteld, between kilometer posts LI and LII, and four at left bank, the

uppermost three under Wamel, the lowermost under Dreumel, between kilometer posts LV and LVIII.

These works reach to 100 meters out of the normal line and were finished in December.

At the end of the year contracts were granted for the execution of a few works under the communes of Druten, Wamel, and Dreumel between kilometer posts XLIV and LVIII.

These works consist of four cribs at the left bank under Druten, near kilometer post XLV, and two cribs also on the left bank near the boundaries between Wamel and Dreumel near post LVIII. The work has not yet been begun.

As regards the navigation of the river, it may be stated that the condition of the fairway was very satisfactory, at least as regards the depth. As regards the place and the direction of the stream transitions, they varied considerably on the part of the river from Druten to the lower mouth on account of the downstream movement of the drift sand. In connection with the crib work carried out last year near the Groenlanden, dredging work still proved necessary, after the completion of which, in June, the fairway continued in its normal position and fully maintained its normal depth. With the lowest water level and open water, at the highest point 2.30 meters was still gauged in December, equal to 3.11 meters at normal low water.

During these exceptionally low-water levels in the autumn at different points, such as Druten, Ophemert, and St. Andries, police supervision and control of the navigation with vessels too deeply immerged was necessary to prevent hindrances and blocks. Yet at all these points the least depth of channel, reduced to the normal low-water level, amounted to more than 2.70 meters. At the part of the river below Bommel the fairway, though at a single point less than the year before, was generally very satisfactory, so that at the lowest water levels only a few deeply laden craft had to wait for the flood, though no vessels had to lighten.

In 1899 seven vessels were sunk on the Waal, owing to collision and other casualties, of which 3 were raised and removed by parties concerned—casualties, and 3 by the state—whilst the seventh is to be cleared away by a government contractor.

The condition of the upper Merwede Channel presented no difficulty to the shipping traffic. Both for the improvement and the maintenance of the existing fairway, 399,500 cubic meters of sand were removed by dredging.

With the exception of a few weeks in August, it was possible to lay down buoys for the demarcation of the channel along the right bank.

On the lower Merwede the situation was favorable to navigation and no dredging was required.

At the lowest level 3.60 meters was still fathomed with an average ebb.

The condition of the Noord was favorable to the shipping, to which the widening of the fairway to 80 meters at the bottom greatly contributed.

Tenders were asked and accepted for the further broadening to 100 meters at the bottom, but the work has not yet been taken in hand.

At the shallowest place, with a middling ebb, 3.40 meters was fathomed.

On the upper and lower Merwede and the Noord five vessels sank and were all cleared away.

The average Rhine freights in 1899 for cargoes of 600/700 tons, towage to destination included, were:

| For ores and other crude commodities to Ruhrort, Duisburg, Hochfeld (per 1,000 kilos): | Florins. |
|---|---|
| First quarter | 0.70–0.75 |
| Second quarter | .75– .77½ |
| Third quarter | .90–1.00 |
| Fourth quarter | 1.40–1.50 |

| For ores to the Middle Rhine (Cologne, Porz, Neuwied/Mülhofen (per 1,000 kilos): | Florins. |
|---|---|
| First quarter | 1.10 |
| Second quarter | 1.15 |
| Third quarter | 1.55 |
| Fourth quarter | 2.45 |

| For ores (copper ore, phosphates, etc., to the upper Rhine and Mayence stations (per 1,000 kilos): | Florins. |
|---|---|
| First quarter | 1.75 |
| Second quarter | 1.80 |
| Third quarter | 2.70 |
| Fourth quarter | 3.35 |

September, October, and November brought very low water, a sharp rise in freights, and abnormally high lighterage; it even happened that one vessel had to lighten two or three times above Cologne to reach its destination. The early unexpected winter also caused a great deal of damage.

Grain in cargoes of ± 400 tons (per 1,000 kilos, including tonnage):

| To the lower Rhine: | Florins. |
|---|---|
| First and second quarter | 0.90 |
| Third quarter | 1.05 |
| Fourth quarter | 1.65 |
| To the middle Rhine: | |
| First quarter | 1.20 |
| Second quarter | 1.35 |
| Third quarter | 1.70 |
| Fourth quarter | 2.60 |
| To the upper Rhine:[a] | |
| First and second quarter | 1.80 |
| Third quarter | 2.90 |
| Fourth quarter | 3.60 |

For grain, in proportion, little more was paid than for crude commodities, which is why the difference with other years is not so great.

Rhine freights per 2,000 kilos were for ores:

| | 1895. | | 1896. | | 1897. | | 1898. | | 1899. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Highest. | Lowest. | Highest. | Lowest. | Highest. | Lowest. | Highest. | Lowest. | Highest. | Lowest. |
| To the Ruhr, exclusive of towage: | *Florins.* | *Florins.* | *Florins.* | *Florins.* | *Florins.* | *Florins.* | *Florins.* | *Florins.* | *Florins.* | *Florins.* |
| First quarter | 2.10 | 0.50 | 2.25 | 0.50 | 1.25 | 0.50 | 1.25 | 0.50 | 0.90 | 0.50 |
| Second quarter | 1.35 | .75 | 1.25 | .60 | 1.20 | .55 | 1.10 | .55 | 1.00 | .70 |
| Third quarter | 2.30 | .55 | 1.45 | .70 | 2.20 | .95 | 2.50 | .70 | 2.00 | .70 |
| Fourth quarter | 2.20 | 1.15 | 2.25 | 1.10 | 2.60 | .75 | 2.75 | .90 | 2.40 | 1.20 |
| To the Middle Rhine, exclusive of towage: | | | | | | | | | | |
| First quarter | 2.10 | 1.20 | 2.10 | .85 | 1.00 | .70 | 1.50 | .80 | 1.25 | .70 |
| Second quarter | 1.25 | .90 | 1.35 | .95 | 1.10 | .70 | 1.20 | .80 | 1.40 | .95 |
| Third quarter | 2.60 | 1.00 | 1.50 | 1.00 | 2.10 | .95 | 4.00 | 1.00 | 2.50 | 1.50 |
| Fourth quarter (till Dec. 12) | 3.10 | 2.10 | 2.60 | 1.30 | ..... | ..... | 4.50 | 1.50 | 2.80 | 1.80 |

[a] Exclusive of lighterage.

After December 13 until January 2, 1900, the Rhine was ice bound; for ore for the Ruhr as much as 4 florins a last (2,000 kilos) was paid, exclusive of towage. A few cargoes had to be discharged elsewhere owing to a want of storage here.

## RHINE NAVIGATION.

For a view of the traffic on the Rhine we give the figures published in the Official Gazette by our Government, which are based on the returns sent in by the Netherlands frontier station and Lobith, which sometimes, however, differ to a slight extent from those of the Emmerich Office, issued by the Central Commission für die Rhein Schiffahrt (Annual Returns of the Central Commission for the Navigation of the Rhine), but on the one hand the difference is very slight and on the other the report of the said commission is published too late for insertion in this review.

The subjoined tables give the traffic returns of the principal Dutch Rhine harbors with Germany, expressed in tons:

*Entries at the principal Dutch Rhine havens.*

| To— | 1899. | 1898. | 1899. | |
|---|---|---|---|---|
| | | | More. | Less. |
| Rotterdam [a] | 558,528.3 | 703,330.2 | ..... | 144,801.9 |
| Amsterdam | 165,106.0 | 168,725.8 | ..... | 3,619.8 |
| Dordrecht | 62,745.9 | 62,204.1 | 541.8 | ..... |
| Nimeguen | 128,602.0 | 143,983.1 | ..... | 15,381.1 |
| Tiel | 16,805.2 | 16,898.5 | ..... | 93.3 |
| Arnheim | 17,274.9 | 19,007.2 | ..... | 1,732.3 |
| Gorkum | 25,977.0 | 26,809.0 | ..... | 832.0 |

[a] It must here be taken into account that of the cargoes destined for these harbors, free goods are already cleared at Lobith, so that those vessels are not included in these figures.

*Clearances from the principal Dutch Rhine havens.*

| From— | 1899. | 1898. | 1899. | |
|---|---|---|---|---|
| | | | More. | Less. |
| Rotterdam | 6,308,636.1 | 5,746,044.8 | 562,591.3 | ..... |
| Amsterdam | 339,703.2 | 295,367.2 | 44,336.0 | ..... |
| Dordrecht | 76,448.9 | 129,693.4 | ..... | 53,244.5 |
| Nimeguen | ..... | ..... | ..... | ..... |
| Tiel | ..... | ..... | ..... | ..... |
| Arnheim | 256.7 | 311.2 | ..... | 54.5 |
| Gorkum | ..... | ..... | ..... | ..... |

*Increase or decrease of the whole traffic of these havens—total in tons.*

| | 1899. | 1898. | 1899. | |
|---|---|---|---|---|
| | | | More. | Less. |
| Rotterdam | 6,867,164.4 | 6,449,375.0 | 417,789.4 | |
| Amsterdam | 504,809.2 | 464,093.0 | 40,716.2 | |
| Dordrecht | 139,194.8 | 191,897.5 | | 52,702.7 |
| Nimeguen | 128,602.0 | 143,983.1 | | 15,381.1 |
| Tiel | 16,805.2 | 16,891.5 | | 93.3 |
| Arnheim | 17,531.6 | 19,318.4 | | 1,786.8 |
| Gorkum | 25,977.0 | 26,809.0 | | 832.0 |
| Total | 7,700,084.2 | 7,312,374.5 | 458,505.6 | 70,795.9 |
| Less | | | 70,795.9 | |
| More in 1899 | | | 387,709.7 | |

The share of Rotterdam in the goods traffic of these havens with Germany was in—

| | Per cent. |
|---|---|
| 1890 | 84 |
| 1891 | 84 |
| 1892 | 84 |
| 1893 | 86 |
| 1894 | 89 |
| 1895 | 89 |
| 1896 | 89 |
| 1897 | 89 |
| 1898 | 89 |
| 1899 | 89½ |

Besides the above mentioned there were in other Dutch ports:

| | 1898. | 1899. |
|---|---|---|
| Entries | 1,826,535.8 | 1,769,580.7 |
| Clearances | 50,279.9 | 73,996.– |
| Total | 1,876,815.7 | 1,843,576.7 |

The total Rhine traffic of the Netherlands with Germany thus amounted to:

| | Tons. |
|---|---|
| 1899 | 9,543,660.9 |
| 1889 | 9,189,190.2 |
| In 1899 (more) | 454,470.7 |

The Rhine traffic between Germany and Belgium was:

| | Tons. |
|---|---|
| 1899 | 2,657,764.7 |
| 1898 | 2,469,306.4 |
| In 1899 (more) | 188,458.3 |

We subjoin a comparative statement of the Rhine navigation of Amsterdam, Rotterdam, and Belgium:

| | Amsterdam. | Rotterdam. | Belgium. |
|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* |
| 1890 | 170,365 | 2,582,791 | 1,165,456 |
| 1891 | 187,557 | 2,598,924 | 1,289,678 |
| 1892 | 211,740 | 2,661,495 | 1,447,016 |
| 1893 | 199,686 | 3,290,048 | 1,310,033 |
| 1894 | 237,109 | 4,130,074 | 1,430,759 |
| 1895 | 242,315 | 3,989,827 | 1,571,765 |
| 1896 | 308,760 | 5,279,513 | 1,940,728 |
| 1897 | 339,498 | 5,914,008 | 1,982,566 |
| 1898 | 464,093 | 6,449,375 | 2,469,306 |
| 1899 | 504,809 | 6,867,164 | 2,657,764 |

*Number of vessels that passed at Lobith from and to Germany.*

| | Total ships. | Under Dutch flag. |
|---|---|---|
| 1890 | 38,529 | 30,448 |
| 1891 | 38,483 | 30,160 |
| 1892 | 38,174 | 30,251 |
| 1893 | 41,427 | 33,280 |
| 1894 | 44,439 | 35,472 |
| 1895 | 40,633 | 31,284 |
| 1896 | 48,072 | 36,205 |
| 1897 | 51,424 | 37,749 |
| 1898 | 58,546 | 42,456 |
| 1899 | 57,289 | 40,634 |

*Total traffic along the Rhine over ten years.*

The following figures are borrowed from the aforementioned German Jahresbericht (Official Annual Returns). The total intercourse on the Rhine, both to and from the German havens themselves, as well as between them and the Netherlands both ways, amounted in thousands of tons to:

| | |
|---|---|
| 1889 | 18,160 |
| 1890 | 19,534 |
| 1891 | 19,695 |
| 1892 | 20,793 |
| 1893 | 21,337 |
| 1894 | 24,629 |
| 1895 | 23,434 |
| 1896 | 30,251 |
| 1897 | 31,579 |
| 1898 | 35,063 |

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O

# CANAL CONNECTING THE RHINE AND THE ELBE RIVERS, IN GERMANY.

## COPY OF AN ACT FOR THE CONSTRUCTION OF A NAVIGABLE CANAL FROM THE RHINE TO THE ELBE, AND REPORT ON PROJECT, DESCRIPTION AND TABLES OF COST, ETC., OF CANALS AND CANALIZED RIVERS IN GERMANY.

Translated by Miss ANNIE M. BRAINARD.

AN ACT For the construction of a navigable canal from the Rhine to the Elbe.

*We, William, by the grace of God King of Prussia, etc., do with the consent of both houses enact the following:*

SECTION 1. The Government is authorized to construct canals connecting the Rhine, the Weser, and the Elbe, and to consist of—

(1) A canal from the Rhine, in the vicinity of Laar, to the Dortmund-Ems Canal, in the vicinity of Herne (the Dortmund-Rhine Canal).

(2) Various complementary works on the Dortmund-Ems Canal in the portion from Dortmund to Bevergern.

(3) A canal from the Dortmund-Ems Canal, in the vicinity of Bevergern, to the Elbe, in the vicinity of Heinrichsberg, below Magdeburg (Central Canal), with branch canals to Osnabruch, Minden, Linden, Wülfel, Hildesheim, Lehrte, Peine, and Magdeburg, including the canalizing of the Weser from Minden to Hameln.

The cost, according to the plans submitted, to be as follows: For 1: Forty-five million two hundred and ninety-eight thousand (45,298,000) marks; for 2: Four million sixty-seven thousand (4,067,000) marks; for 3: Two hundred and eleven million four hundred and nineteen thousand seven hundred (211,419,700) marks, or a total of 260,784,700 marks.

Any surplus in any one of the foregoing amounts to be applied to the others.

SEC. 2. The execution of the works designated under paragraph 1 is to be undertaken only under the condition that before July 1, 1900, the provinces interested or other public districts, communities, etc., other than the Government, undertake, in binding form, the following obligations:

1. In regard to the Dortmund-Rhine Canal, described in section 1, to guarantee to the Government, for each fiscal year, to the amount of 509,200 marks, any possible deficit in the cost of care and operation of the Dortmund-Rhine Canal not covered by the navigation tolls and other such receipts collected on the same; further, to pay

*

interest each fiscal year, from their own treasuries, on a share of the cost of construction amounting to 15,099,330 marks, at 3 per cent, and one-half per cent, together with the interest saved, toward the liquidation of the debt, in so far as the revenue of the Dortmund-Rhine Canal, after deducting the cost of care and operation, does not suffice for the interest and payment of the capital.

2. In regard to the Central Canal, with the branch canals above, mentioned, and the canalizing of the Weser from Minden to Hameln described in section 1 under 3, to guarantee to the State for each fiscal year to the amount of 1,623,300 marks any deficit in the cost of care and operation of these waterways, as estimated by the minister of the department, and not covered by the navigation tolls and such like receipts of said waterways; further, to pay interest, each fiscal year, out of their own treasuries, on a share of the cost of construction to the amount of 78,049,980 marks, at 3 per cent and one-half per cent, together with the interest saved, toward the liquidation of the debt, in so far as the revenue of these waterways, after deducting the cost of care and operation, does not suffice for the interest and payment of the joint capital invested for the building of the Central Canal, with its branch canals, and the canalizing of the Weser from Minden to Hameln at 3½ per cent.

SEC. 3. The minister under whose department the work will be placed, in conjunction with the minister of finance, can postpone the assumption by the States of the obligation to pay their share of the cost of construction at one-half per cent per annum, until the sixteenth year after the time indicated for the opening of the Dortmund-Rhine Canal and the Central Canal.

SEC. 4. Should the receipts of the works described above under section 1, 1 and 2, exceed in any one fiscal year the cost of care and operation, as well as the interest and payments on capital at 3½ per cent, the surplus shall be used first for further payment on the capital; and when these payments are completed, for the paying back of all additional sums contributed by the Government or provinces, districts, etc., in former years, in proportion to the amounts; next, for the restitution of the interest on the capital paid out by the State and finally for the repayment of the amount of interest for this latter as well as for the additional contributions of the State and provinces in proportion to the amount of this interest.

SEC. 5. The amounts to be paid to the Government on the basis of the aforementioned guaranties, or any one of these amounts, are to be fixed definitely, each fiscal year, by the minister of the department and the minister of finance, after the representatives of the provinces, districts, etc., have been heard.

SEC. 6. The direction of the law as to the amount of tax to be placed on single districts or parts of districts, as well as sections 9 and 20 of the law of communal taxation (Kommunalabgabengesetzes) of July 14, 1893, shall be applied in regard to the raising and division of the increasing burden to be placed upon the provinces, districts, and communities as a result of these obligations.

SEC. 7. In order to provide for the expenses mentioned in section 1, the minister of finance is empowered to issue a corresponding amount of government bonds, in the form of a loan. The minister of finance shall decide when, at what place, in what amounts, at what interest, under what conditions, and at what market value the

bonds shall be issued. As for the rest, in regard to the management and liquidation of the loan, as also in regard to the limitation of the interest, the law of December 19, 1869, is to be applied.

SEC. 8. The carrying out of this bill is given to the minister of the department under which it is placed, except where in sections 3, 5, and 7 it is under the minister of finance, or with his concurrence.

Signed by:

V. MIQUEL,
*The Minister of Finance.*

FRHR. V. HAMMERSTEIN,
*The Minister of Agriculture, Lands, and Forests.*

THIELEN,
*The Minister of Public Works.*

BREFELD,
*The Minister of Commerce and Trade.*

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## REPORT.

[To this report is added three maps, and a memorial on the project of a canal from the Rhine to the Elbe, in two parts, by Government Inspector Prüsmann.][a]

During the last few years inland navigation in Germany has, in consequence of the improvement of the channels of the great rivers, and the establishment of artificial waterways, greatly developed, both in regard to the extent, speed, safety, and cheapness of its business, as well as in the size and condition of its boats.

The amount of freight transported by inland navigation, reckoned according to kilometers and tons, or by ton-kilometers, has increased during the last twenty years from 2,900,000,000 to 7,500,000,000, or 159 per cent; whereas the amount carried by the railroad during the same time has risen from 10,900,000,000 to 26,500,000,000, or 143 per cent. Of the entire traffic of Germany at the present time about 78 per cent falls to the railroads and 22 per cent to the waterways. From 1875 to 1895 the traffic on the Oder rose from 154,000,000 to 634,000,000 the ton-kilometer; on the Elbe, from 435,000,000 to 1,952,000,000 the ton-kilometer; on the Rhine, from 882,000,000 to 3,030,000,000 the ton-kilometer. The volume of traffic on the Rhine is not equaled by that of any inland waterway of Europe, and is only surpassed by the Great Lakes of North America.

In answer to the question whether, in a given case, a railway or an artificial waterway is to be preferred for the transportation of freight, the geological formation of the country must first be taken into consideration. The surface of north Germany is by nature especially well suited to the establishment of a system of canals reaching from the Rhine to the Weichsel, there being only the low-water sheds which divide the many streams flowing from south to north to cut through in order to construct a waterway which shall run from west to east through the entire country and connect the different river basins of the Empire. In the subjoined map, No. 1, this network of waterways, and its completion by means of the Rhine-Elbe Canal, is shown. The abundance of water in the rivers to be crossed assures

[a] The maps and memorial mentioned above have not been reproduced as a part of this document.

a plentiful supply for feeding the canal. In that respect Germany is much better equipped than any other country on the Continent—than France, for instance, who has, nevertheless, developed her canal system to a remarkable extent.

The country lying between the Elbe and the Weichsel has long possessed a system of connecting waterways, though not in all parts a complete one. The efforts, however, to establish a canal which would connect the Rhine, the Ems, the Weser, and the Elbe, and thereby make possible inland navigation between the western and eastern States, have hitherto come to no results, though the idea has been agitated many times since 1856.

In the bill of July 9, 1886, for the construction of new canals and the improvement of existing waterways, the subject was referred to in the following manner:

> The Government is authorized to appropriate, according to the estimation submitted by the minister of public works, 58,400,000 marks for the construction of a canal to connect the Rhine with the Ems, and these streams, in a similar manner, with the middle and lower Weser and Elbe; and, first of all, for the construction of a canal from Dortmund or Herne, past Henrichenburg, Münster, Bervergern, and Papenburg, to the lower Ems, including the building of a side canal from the Ems at Oldersum to the port of Emden, and a corresponding widening of the harbor at the latter.

Although there was no legal compulsion laid upon the legislature by the bill of 1886 to construct the remaining part of the canal system here indicated, after the building of the Dortmund-Ems Canal, still the Government can not avoid the obligation of further pursuing the direction given in that statute. It considers the resolution as passed by the lawmakers at that time as right, and the carrying of it out as essential. Therefore, as early as April 17, 1894, a project for the construction of a canal from the Dortmund-Ems Canal to the Rhine was laid before the Landtag, in which the Government proposed the construction of the western part of the Rhine-Elbe Canal. This bill was lost in the House of Deputies on May 18 of the same year.

Since that time the reasons for the construction of a canal from the Rhine to the Elbe have become much more pressing; the increase in traffic, especially in the industrial district of Rhenish Westphalia, urges the necessity of the construction of a way of transportation capable of coping with the immense trade. The first suggestion would be to extend the railroads already belonging to the State, and which this great traffic has created and made possible. The railroads at present are still able, with great effort, to accommodate the heavy demands upon them, and with the necessary improvements would be able to do so for some time longer. But it is evident that with the constantly increasing development in traffic the railroads alone, or even in conjunction with the natural waterways, would be unable to respond in full to the needs of highly developed industries so that they could compete successfully with the trade of other countries in their own, as well as in foreign, markets. A still greater division in the work of transportation between the railway and the waterway is inevitable, the waterway carrying more and more of the heavier and bulky goods, and the railway the more valuable goods and such as require speed. It is the duty of the Government, as well as of the representatives of the country, to see that, in due time and in a judicious manner, the means of transportation be increased, and that as soon as possible an adequate water-

way be constructed. Both ways of transportation, the one supplementing the other, would then be enabled to assist in promoting the greater prosperity of this most important part of the fatherland.

The Government, therefore, in the above bill proposes the construction of a canal from the Rhine to the Elbe, in the conviction that this canal is necessary to the interest of trade and to the interest of home production, and that the common welfare of the country would suffer should this work not be undertaken without delay.

It is intended that the proportions of this canal should be the same as those of the Dortmund-Ems Canal, from which the essential features of the Rhine-Elbe will be copied; it will therefore be built for boats of from 600 to 750 tons.

In laying out the plan of these works every effort has been made to further the interests of agriculture by bettering the condition of the water supply.

To prevent any possible doubt arising as to the meaning of the following statements in regard to the rate of navigation tolls and railroad tariffs to be hereafter followed, it is especially pointed out that these statements are designed only as a basis of reckoning for determining the amount of canal traffic, the loss to railroad revenues, etc. The Government does not intend to be bound in the future in any way by these statements.

The following technical description of the Rhine-Elbe Canal contains only the chief characteristics of the project, while for all details one is referred to the paper by Prüsmann. In that the economic significance of the great undertaking is discussed, and also the expected cooperation of the interested provinces in its execution and management.

## DESCRIPTION OF THE RHINE-ELBE CANAL.

The following divisions of the canal show the extent of the undertaking:

### A. DORTMUND-RHINE CANAL.

1. The main canal branching off from the Dortmund-Ems Canal near Herne, and running to the Rhine near Laar, to be called the Emscher Valley Canal.
2. An aqueduct for bringing the water from the Ruhr at Hohenyburg and steam pump works at Münster.

### B. COMPLETION OF THE DORTMUND-EMS CANAL.

1. A series of locks at Heinrichenburg.
2. Second lock at Münster.

### C. CENTRAL CANAL.

1. The main canal from Bevergern passed Minden, Hanover, Neuhaldensleben to the Elbe near Heinrichsberg.
2. An aqueduct for bringing the water from the Weser at Rinteln, and from the Leine at Coldingen, to the main canal.
3. Branch canals to Osnabrüch, to the Weser at Minden, to Linden, to Wülful and Hildesheim, to Lehrte, to Peine, and to Magdeburg.

The branch canal to Braunschweig, indicated in the plan, will eventually be built by the Braunschweig government.

### D. THE CANALIZING OF THE WESER FROM HAMELN TO BREMEN.

Of this work only the part from Minden to Hameln comes under this bill, as it is assumed that the execution of the part from Minden to Bremen belongs to the free city of Bremen.

The execution of all of these undertakings has been approved by all of the provinces interested, and part of the cost of the preliminary work has been also borne by them. The project is worked out according to the directions of the minister of public works and placed under his department. It goes without saying that at present only a general, though careful and painstaking, preliminary scheme, based on preliminary work, has been brought forward, on the foundation of which the final plans will be worked out according to the amount of money appropriated. It is therefore explicitly stated that in the final detailed working out of the preparatory plans important changes in the line taken by the canal will doubtless occur, particularly as the territory through which the canal will pass undergoes continual changes in regard to its cultivation and the like.

## THE DORTMUND-RHINE CANAL (LAAR-HERNE).

The territory under consideration for connecting the Dortmund-Ems Canal with the Rhine, and which belongs to the jurisdictions of Düsseldorf, Arnsberg, and Münster, is shown in the subjoined map No. 3 of the industrial district of Rhenish-Westphalia. The completed Dortmund-Ems Canal is shown by a blue line and the proposed Dortmund-Rhine Canal by a red line.

The surface formation of this district is determined by the Rhine, Lippe, Emscher, and Ruhr rivers, and the Haarstrang Mountains, with their lower slopes to the Ardey and Haardt. From a hydrographic point of view these rivers, the Lippe, Emscher, and Ruhr, flowing west and emptying into the Rhine, are of the greatest importance, the Lippe and the Ruhr coming first in regard to feeding the canal.

While the Lippe lies outside the industrial district, and therefore the purity of its waters is not contaminated by factories, etc., and the Ruhr, in spite of the proximity of many industries, furnishes a suitable water for the great number of waterworks needed to supply the industrial district, the Emscher, with its low-rising slopes and innumerable little streams, forms the natural drainage channel for all the dirty water of this valley so rich in industries. In spite of the new drainage and filter works of the large cities, it is here, in its upper course, of little use for the purpose of a canal, at least if one does not contemplate a continual dredging of the masses of slime. In the lower portion of the river the condition of the Emscher is somewhat better, owing chiefly to the great quantity of water flowing in from the pumping works of the mines and the drainage of the marshes of the lower Emscher and which is each year increasing. The Lippe already supplies the Dortmund-Ems Canal with water, therefore it is intended to feed the Dortmund-Rhine Canal by means of an aqueduct from the Ruhr, starting from some point near Syburg. But as the Ruhr requires careful using, for the reason that the industrial district depends upon it for its water supply, there will also be a pump established at the lock near Münster in order that water may be taken from the Central Canal in times of low water.

The principal purpose of the Dortmund-Rhine Canal is to connect the industrial district of Westphalia lying east of the Rhine as closely as possible with the navigable waters of the Rhine on the one side and with the Dortmund-Ems Canal and the proposed Central Canal on the other. Moreover the canal would open up traffic between the Rhine and the industrial district and the provinces lying east of the Elbe. The shortest line of communication between the Rhine and the Dortmund-Ems Canal runs from Herne along the valley of the Emscher. The course of the canal through the middle of the industrial district and its discharge into the Rhine as far upstream as possible are especially desirable features; opposed to which is the disadvantage of having to cut its bed through a coal district, and the somewhat higher cost.

The Lippe route, though costing less, is half as long again as the direct canal line from Herne to the Rhine; it passes through but few of the principal industrial districts, and empties into the Rhine too far downstream to get the trade directed to the upper Rhine. It would, therefore, be of little use to the greater part of the industrial district. The construction of a canal on the south side of the Emscher, as suggested in the bill of 1894, is no longer possible, on account of the great number of works of all kinds that have since then been erected there. For these reasons the construction of the Emscher Valley Canal, with everything appertaining to it, as indicated in map 3, is recommended.

The direction taken, and the longitudinal profile of this canal, which is to be 39.5 kilometers long, follows the general slope of the land toward the Rhine. According to the foregoing plans it is to begin at the Dortmund-Ems Canal near Herne, 2 kilometers west of the present end of the latter; is to continue, with the aid of two locks of 6 and 5 meters fall, along the valley of the Emscher; and to follow the river on the southern bank, though quite independently of it, in three sections, past Crange and Carnap to Oberhausen. From here to the Rhine (near Laar) the canal is to run with the river. In this portion there are two flights of locks (Staustufen). The Emscher Valley Canal will have seven locks altogether, with a total fall of 33.5 meters (mit einem Gesammtgefalle bei mittlerem Rheinwasserstand von $56.0-22.5=33.5$ m.).

As the waterway, in general, cuts deep into the land, the bridging over of the canal when crossed by a railroad would offer no difficulties; neither would side embankments be necessary, except in isolated cases.

The question as to whether it would be possible, in compliance with the wishes of different interested parties, to lay the canal in the bed of the Emscher in its upper part as well as in the lower, will be carefully examined into when the project is worked out in detail.

The Emscher Valley Canal is to conform to the Dortmund-Ems Canal in its dimensions, and accordingly will have a width of 30 meters at the surface, 18 meters at the bottom, and a depth of 2.5 meters.

In the valley through which the canal would run are innumerable mines, the working of which produces a certain sinking or caving in of the ground. It has been ascertained, however, after careful inquiry, that these cave-ins present no real danger to a canal if their extent and size is limited as much as possible by mining regulations

(which may be ordered by the State, if necessary), and if proper care is taken that they occur uniformly and are of similar proportions. The Westphalian coal mines come to the surface in the southern portion, and are only covered over by fresh strata of so-called calcareous marl (shown in appendix 6 of part 2 of the memorial by a red line). The thickness of the marl increases toward the north at an angle of from 2 to 3 degrees, so that in the line of the Emscher Valley Canal it already attains a thickness of from 160 to 200 meters. The coal in this district has, up to the present time, been worked usually without filling in; that is to say, the coal has been taken from the bed without filling up the cavity thus made with other rock or mineral—as, for instance, with the material obtained by the tunneling through to the strata of coal, or especially with the mass of daily refuse taken from the mine.

These cave-ins, arising from the junction of two chambers in a mine, have, according to experience, almost never broken through to the surface when the covering of marl had attained a possible thickness of 50 meters; that is to say, that in such places there are no visible cracks or chasms on the upper surface. In such places there is only a slight sinking of the ground, the water courses remaining unchanged, and only the height of the water bed being altered. Should this change be so important as to hinder the flow of water, the marshes and inundations arising from it must be drained and made capable of cultivation by means of draining canals, while the course of the water can be protected and kept high by means of embankments. It follows, therefore, that the strata of marl possess a certain elasticity and are able to support the weight of water. Consequently there is as little danger to a water course above ground if the needful depth and current is preserved and the overflowing of the banks prevented by dikes as there is to the mines from the introduction of surface water into the pits.

Even in districts where the crust of marl has only a comparatively slight strength numerous cases have been observed of the gradual sinking of railroads, roads, bridges, and buildings of all kinds without the traffic of the same being in any way injured or their usefulness destroyed.

The effects of these cave-ins would be greatly decreased if the excavation everywhere in the district through which the proposed canal was to run should be filled in with the greatest amount possible of refuse mineral. It is an indisputable fact, however, that the effect upon the surface of mining operations decreases in proportion to the depth of the same, and that the cave-ins, which will happen in any case underground, will decrease more and more, and therefore become less noticeable on the surface.

During the last few years this whole subject has been thoroughly investigated and settled, and these investigations have led to the conviction that there is no serious danger to a mine from a canal, nor to a canal from a mine.

It should be the business of the mine authorities to watch the progress of the working of the mines, so as to assure ample protection to the canal, and to consider, in due time, whether a special order should not be passed if, for instance, it is intended to carry the mining operations in one particular field down deeper than that in a neighboring field. Should the working of the mine downward

progress uniformly in a measure only, its influence upon the surface would also be proportionally uniform and gradual, and its effects as gradually effaced.

As the Emscher Valley route lies for the most part close to the Emscher itself, and as this river must be protected against such effects of the mining as might produce unequal cave-ins and consequent disturbances to the flow of water, it will not be necessary to take any measures beyond those already taken for the protection of the Emscher itself.

In Belgium only has there been any experience with the effect of mining operations on navigable canals, and there the mines have not been taken into consideration in constructing the canals, though the coal beds are not overlaid by a protective covering, such as the marl affords. For all that, the canals there have not as yet been injured.

According to experience as to the effect of these cave-ins, the banks and towpath of canals in all places where such cave-ins are to be expected should have a greater breadth (perhaps 10 meters) so that it would be possible to elevate them without widening the banks, Moreover they should be so built that they would gradually sink with the ground without injury.

The locks should be double, always two together, and so built that in the ordinary working of them they would act as additional reservoirs for each other. One lock should be 67 meters long, the other 97 meters, in order to pass a tug and two loaded barges at one lockage; the width should be 8.6 meters, and the elevation of miter sills 3 meters (die Drempletiefe 3 meters); in a sinking district the latter should measure more.

The bridges, of which there are 53 altogether, or an average of one to every 700 meters, are planned in the first estimate as raftered bridges (Balkenbrücken) of 37.5 meters span, and with a clear height of at least 4 meters above the highest water mark. Upon the appearance of a cave-in precautions are taken by increasing the elevation of the bridges.

Intersecting streams, when they are not turned into the canal, are carried through by means of ducts and culverts under the canal. Care must be taken in their construction that any change in their bed caused by a cave in shall not affect them injuriously.

No money has been appropriated in the preliminary estimate for the building of harbors, as the construction of harbors belongs to the communities and parties benefited. Doubtless numerous private harbors and lading places, as well as larger harbors for unloading and reloading, will spring up along the canal.

The building of the canal is in no way opposed to the agricultural interests; on the contrary, great advantages may be counted upon from the improvement in regard to floods, etc. In general, the agricultural interests in the districts which are mostly given up to industries are of secondary importance, and it is very necessary that the drainage waters which will flow in from the mining operations and from the increasing number of towns be taken well into consideration.

According to section 4 of the memorial the cost of the building of the Emscher Valley Canal, including the feeding works, will be 45,298,000 marks, and the yearly cost of care, maintenance, and operation 509,200 marks.

### COMPLETION OF THE DORTMUND-EMS CANAL.

The middle section of the Rhine-Elbe Canal will consist of the completed Dortmund-Ems Canal from Herne to Bevergern. The traffic on this part of the canal will be greatly increased after the junction with the Emscher Valley and the Central canals, as it will then be used for navigation toward the Rhine, toward the Weser, and toward the Ems ports. For this reason a second lock at Münster is contemplated. Moreover, as the trade of Dortmund, the most important port on the canal, will be greatly increased after the building of the Rhine-Elbe Canal, a system of locks is to be established at Henrichenburg near the ship elevator (Schiffshebewerk) which will share the traffic passing to and from Dortmund and which will be provided with the necessary water supply from the Ruhr Aqueduct. This series of locks, which will consist of three, with a fall of 4.67 meters each, will also take the place of the elevator in case of any possible disturbance in its working and would make a direct connection with Dortmund possible. The cost of the construction of these locks will be 2,629,000 marks.

The second lock at Münster, the building of which was already contemplated at the time of the construction of the Dortmund-Ems Canal, is planned as a large lock of 95 meters in length in order to pass a loaded barge with its tug at one lockage. Its cost, including some earth works on the Dortmund-Ems Canal, will be 1,438,000 marks.

The completion of the Dortmund-Ems Canal, which would be essential when the Rhine-Elbe Canal is constructed, would cost besides, altogether, 4,067,000 marks, and the yearly cost of care and operation would amount to 36,600 marks.

### CENTRAL CANAL (BEVERGERN-ELBE).

The Central Canal, which is shown in map 2, will connect the middle part of the Dortmund-Ems Canal and the middle Weser and Elbe. It is to run through the low plains of north Germany, which slope gently toward the north and are crossed by many rivers, and will run from east to west along the northern edge of the hills which bound it, under such favorable circumstances that a better place could hardly be imagined for a great canal system.

The construction of the canal can be carried out without difficulty, a longitudinal profile particularly well adapted to navigation will be possible, and a plentiful supply of water assured. At the same time the canal crosses the rivers above mentioned at such auspicious points that both the seaports as well as the upper portions of the rivers can be reached by a comparatively short route.

The project before us comprises the building of the through main canal and the building of eight branch canals, to which is added the completion of the canalizing of the Weser from Hameln to Bremen.

The main canal of 325 kilometers in length branches from the Dortmund-Ems Canal at Bevergern, thence past Bramsche and Lubbeck northerly to Minden, where it crosses the Weser; thence on through the principality of Schamburg-Lippe to Hanover, and then runs in part through the Braunschweig territory, past Neuhaldensleben and Wolmirstedt, to the Elbe at Heinrichsberg, opposite to the

new Plaue Canal, which forms the commencement of the network of canals east of the Elbe. Branch canals are to be constructed to Osnabrück (15.4 kilometers), to Minden (3.2 kilometers), to Linden (11.9 kilometers), to Wülful (6.4 kilometers), to Hildesheim (23.6 kilometers), to Lehrte (2.6 kilometers), to Peine (15.6 kilometers), and to Magdeburg (10 kilometers).

The main canal will be a two-ship waterway, laid out in a straight line, avoiding curves of under 500 meters radius; the second mouth into the Elbe at Magdeburg, and the canal connecting with the Weser at Minden, as well as the branch canal to Linden, will also be built for two ships. A single-ship waterway will suffice for the branch canals to Osnabrück, Wülful, Hildesheim, Lehrte, and Peine.

In the watershed between the Weser and Elbe, near Oebisfelde, is an extensive low-lying country, the so-called "Drömling," which can not be avoided by the canal, and the extent and peculiarities of which (carefully explained in the memorial) must be taken into careful consideration when the canal is built. On account of the agricultural interests of this district the water level of the canal in the section east of Hanover is placed at 56.6 meters above the level of the sea (?) (auf N. N. +56.6 m.). The descent from this section of the Elbe is made by four locks in the Ohre Valley.

The water level of the western part of the canal between Hanover and Bevergern would be based upon that of the Dortmund-Ems Canal at Bevergern, which is 49.8 meters above sea level (N. N. + 49.8 m.), as this elevation is well adapted to the level of the intersecting rivers and the condition of the Gründwasserstände. The longitudinal profile of the canal, with the longest section, of 210 kilometers, between Münster and Hanover, and a western section, between Hanover and Oeberfelde, is most favorable for a great navigable highway, especially as the immense traffic which is expected on the Central Canal will have no locks to pass through between Hanover and the Weser on the one side and the Rhenish industrial district on the other; only the traffic to the Elbe will have to ascend to the high section east of Hanover, caused by the Drömling, and descend again to the Elbe by means of locks.

On the western part of the Central Canal the branch canals are locked in such a way that the ascent to Osnabrück will be effected through two locks; the ascent to the Weser at Minden also through two locks; the connection with the north part of the city of Hanover without a lock; the ascent to Linden through one lock; and the descent to the Leine and to the central part of Hanover also through one lock. In the eastern section, beginning at Hanover, the joining of the branch canals to Wülful and Lehrte will be effected without locks, the ascent to Hildesheim with three, and the ascent to Peine with one.

The dimensions of the Central Canal will be based on those of the Dortmund-Ems Canal, which consist in 2.50 meters depth, 18 meters breadth at bottom, 30 meters at surface, and 4 meters clear height under the bridges. On both banks of the canal is to be a towpath 3.5 meters wide and 1.5 meters above the level of the water, and a side ditch beyond, with a strip of land between of 1 meter in width to protect the embankment. For the branch canals, in so far as they are built for one ship, with occasional places for passing, the

same measurements will be used with a decrease in the width at the bottom from 18 meters to 10 meters.

The locks are to be built in compartments between straight walls, and in places where there is a great fall, and where a proportionate diminution in the water supply seems likely, there will be side reservoirs holding 50 per cent less than the locks themselves. These locks will pass but one vessel at a time, only the locks on the Elbe at Heinrichsburg, through which will pass not only the traffic from the Central Canal, but also that from Magdeburg to the network of canals east of the Elbe, being designed as locks of 165 meters in length and 12 in width for the accommodation of a towboat and its train of barges at one lockage. The lock in the branch canal at Magdeburg is to have the same width, so that the wide ships of the Elbe can navigate on the canal from Magdeburg to Heinrichsberg, and thereby lighten the work of this lock, which is nearly always open.

Strong iron bridges, 37.5 meters long, are to be used for the crossing of roads and railways, by means of which all possibility of accident or disturbance to the traffic on either intersecting highway will be avoided. Ducts and culverts are directed to be placed wherever rivers or little brooks are to be carried under the canal. Gates for shutting off the water and safety gates are proposed, so as to be able to shut off the canal, at times, in order to lay dry parts of the canal, and also to prevent the banking up of the water by the wind upon long open stretches of the canal.

The descent to the Weser above Minden, which is made by means of two locks, is so arranged that a large harbor of refuge can be located there.

At Hanover, the principal city on the Central Canal, it is so arranged that two harbors, one on the east and one on the west side of the city, can be constructed. As for the rest, no provision has been made in the estimation for the building of harbors on the Central Canal or its branches, the which are left rather to the parties benefited. It is naturally understood, however, that in the laying out of the canal care shall be taked so that at all suitable places harbors can, at any time, be established.

The question as to the water necessary for feeding the canals has been thoroughly investigated, the results of which have been given in section 3 of the memorial. It need only be remarked here that a plentiful supply from the rivers crossed by the canal, especially from the Weser, Leine, and Elbe, is thoroughly assured. In the above-mentioned section 3 certain improvements, by means of the canal, are bespoken in the interest of agriculture, such as drainage, irrigation, and canals for carrying off the water in times of flood; these are particularly valuable on a long canal, connecting a great number of streams and brooks of different river basins, as by means of them the varying meteorological effects of rain, etc., can be profitably used.

Of the 325 kilometers of the main canal, 61 kilometers (19 per cent) lie in the province of Westphalia, 146 kilometers (44 per cent) lie in the province of Hanover, 16 kilometers (5 per cent) lie in the province of Hessen-Nassau, 61 kilometers (19 per cent) lie in the province of Saxony, 22 kilometers (7 per cent) lie in the Principality of

Schaumburg-Lippe, and 19 kilometers (6 per cent) lie in the Duchy of Braunschweig.

Of the 89 kilometers of branch canals, 3 kilometers lie in the province of Westphalia, 76 kilometers lie in the province of Hanover, and 10 kilometers lie in the province of Saxony.

The length of the entire canal from the Rhine to the Elbe, including the 102 kilometers of the Dortmund-Ems Canal, which forms part of it, is 466 kilometers.

The Central Canal will be accessible at all times to the water traffic between the Elbe and the waterways of Brandenburg. It will also be so arranged that the vessels plying the Brandenburg waterways can reach the Central Canal even during low water on the Elbe.

### CANALIZATION OF THE WESER (FROM HAMELN TO BREMEN).

To the canal proper must be added the canalizing of the Weser from Hameln to Bremen, which will be essential when arrangements are made to feed the Rhine-Elbe from this river, if water is to be taken even in times of drought, as otherwise there would be danger that the lowering of the level of the water, though not great, might harm the agricultural interests of that district, as well as injure navigation on the river. The water for the canal is to be taken at Rinteln, and it would, therefore, be sufficient to canalize the river up to this point, but, since the most important trading center for the traffic of the upper Weser, Hameln, lies not far above, it is designed to continue the canalization to this point.

The distance to be canalized from Hameln to Minden is 61.1 kilometers; from Minden to Bremen 149.3 kilometers. On the first there will be 10 locks and dams, on the latter 15. The measurements of this waterway will be so chosen that there may be an uninterrupted traffic between it and the Central Canal. The great width of the steam and freight boats which at present navigate the river will be taken into consideration in planning the width of the locks. The locks below Minden are to be large enough to hold two or more boats at a lockage.

The project, which is more minutely described in the memorial, will likely undergo some changes in its details, as its execution, in the stretch from Minden down, is to be undertaken by the free city of Bremen, which would thereby maintain its connection with the network of inland waterways. For this part of the work, therefore, no provision is made in the foregoing bill. It may be mentioned, however, that the preliminary estimation of the cost of construction within the territory of Bremen is 3,322,000 marks, and for that part lying in Prussian territory 39,306,000 marks, a total of 42,628,000 marks.

### CAPACITY OF THE CANAL.

In regard to the carrying capacity of the canal one must descriminate between that of the open, and that of the locked parts, the latter being of more determining significance, unless a very long stretch without locks is being considered. According to the calculations given, in which the passage of a train of boats, consisting of a tug and one or two barges, is assumed, the open stretches of the canal, with a working day of thirteen hours, would have a yearly capacity

of 10,000,000, and with a working day of twenty-two hours, a yearly capacity of 16,000,000.

The locks on the Dortmund-Rhine Canal, which are designed as double locks, would have a yearly capacity of, at least, 8,000,000 tons, and the locks on the Central could manage 4,000,000. As the nearest lock to the industrial district on the Central would be east of Hanover, where the traffic would be considerably less, the capacity of the canal, even here, would suffice for all traffic which may be expected in the future. Places will be provided, however, for any further increase in locks which might be needed, and the increase in revenue, caused by the growing traffic would furnish the money for constructing the same. To construct locks now, for a problematic future need, would be poor economy. No blockade on the canal from the insufficient capacity of the locks need be anticipated, however, in spite of the great increase in traffic which is confidently expected.

## DESCRIPTION AND COST OF RHINE-ELBE CANAL.

The estimations given as to the size and cost are based upon the local experiences at the time of the building of the Dortmund-Ems Canal. In order to find the best ground for laying the bed of the canal, borings will be made all along the line to be followed.

In the following table is given the length of single parts of the canal; the number of locks, and the cost of building, as well as the yearly cost of maintenance and operation. It will be noticed that for the Weser only the extra cost of maintenance, following the canalizing of the river, is given.

1. DORTMUND-RHINE CANAL—EMSCHER VALLEY CANAL (LAAR-HERNE).

| Description of canal. | Length of single parts. | Total length. | Number of locks. | Cost of construction. | | Yearly cost of care and operation. |
|---|---|---|---|---|---|---|
| | | | | Single parts. | Total. | |
| 1a. Canal from Herne-Schalke to Oberhausen rolling mills. | *Km.* 28.1 | *Km.* | 5 | *Marks.* | *Marks.* 28,867,000 | *Marks.* |
| 1b. Canalized part from Oberhausen rolling mills to the Rhine | 11.4 | | 2 | | 12,000,000 | 331,400 |
| 2. Aqueduct from Hohensyburg | (15.6) | | | 4,171,000 | | |
| 3. Steam-pump works at Münster | | | | 260,000 | | 127,800 |
| 1. Total | | 39.5 | 7 | | 45,298,000 | 509,200 |

2. COMPLETION OF THE DORTMUND-EMS CANAL.

| | | | | | | |
|---|---|---|---|---|---|---|
| 1. Series of locks at Henrichenburg | 1.1 | | 3 | | 2,629,000 | |
| 2. Second lock at Münster | .2 | | 1 | | 1,438,000 | 36,600 |
| 2. Total | | 1.3 | 4 | | 4,067,000 | 36,600 |

3. CENTRAL CANAL (BEVERGERN-ELBE) WITH 8 BRANCH CANALS AND CANALIZING OF WESER.

| Description of canal. | Length of single parts. | Total length. | Number of locks. | Cost of construction. | | Yearly cost of care and operation. |
|---|---|---|---|---|---|---|
| | | | | Single parts. | Total. | |
| MAIN CANAL. | | | | | | |
| 1. Canal from Bevergern-Hanover | *Km.* 174.5 | *Km.* | | *Marks.* 79,682,400 | *Marks.* | *Marks.* |
| 2. Canal from Hanover-Elbe | 150.4 | | 5 | 58,952,000 | | |
| Total main canal | | 324.9 | 5 | | 138,634,400 | |
| FEEDING WORKS. | | | | | | |
| 3. Weser Aqueduct from Rinteln | (21.6) | | | 5,027,000 | | |
| 4. Leine Aqueduct from Coldingen | (12.8) | | | 6,848,000 | | |
| 5. Electric pump works at Hanover and Jersleben and draining works | | | | 827,800 | | |
| Total feeding works | | | | | 12,702,800 | |
| Total 1–5 of main canal | | 324.9 | 5 | | 151,337,200 | |
| TWO-SHIP BRANCH CANALS. | | | | | | 1,347,300 |
| 6. Descent to the Weser (Minden) | 3.2 | | 2 | 4,707,000 | | |
| 7. Canal to Linden (Leine) | 11.9 | | 2 | 7,556,000 | | |
| 8. Canal to Magdeburg | 10.0 | | 1 | 5,428,000 | | |
| Total 6–8 two-ship branch canals | | 25.1 | 5 | | 17,691,000 | |
| ONE-SHIP BRANCH CANALS. | | | | | | |
| 9. Canal to Osnabrück | 15.4 | | 2 | 5,314,500 | | |
| 10. Canal to Wülfel (making Leine Aqueduct navigable) | 6.4 | | | 1,000,000 | | |
| 11. Canal to Hildesheim | 23.6 | | 3 | 9,485,000 | | |
| 12. Canal to Lehrte | 2.6 | | | 449,000 | | |
| 13. Canal to Peine | 15.6 | | 1 | 6,392,000 | | |
| Total 9–13 branch canals | | 63.6 | 6 | | 22,640,500 | |
| Total central and 8 branch canals | | 413.6 | 16 | | 191,663,700 | 1,347,300 |
| CANALIZING OF WESER (BREMEN TO HAMELN). | | | | | | |
| 14. Within Bremen territory | (10.9) | | (1) | | | |
| 15. From Bremen border to Minden | (138.4) | | (14) | | | |
| 16. From Minden to above Rinteln | 43.4 | 61.1 | 7 | 14,622,000 | 19,751,000 | 193,200 |
| 17. From Rinteln to Hameln | 17.7 | | 3 | 5,129,000 | | 82,800 |
| Total Central Canal, etc | | 474.7 | 26 | | 211,419,700 | 1,623,300 |

| | Cost of construction. | Care and operation. |
|---|---|---|
| | *Marks.* | *Marks.* |
| Dortmund-Rhine Canal | 45,298,000 | 509,200 |
| Completion of Dortmund-Ems Canal | 4,067,000 | 36,600 |
| Central Canal and branch canals | 191,668,700 | 1,347,300 |
| Canalizing of Weser from Hameln to Minden | 19,751,000 | 276,000 |
| Total (falling to Prussia) | 260,784,700 | 2,169,100 |

According to these estimates, the cost in proportion to the kilometer amounts to 1,147,000 marks for the Dortmund-Rhine Canal; 465,000 marks for the Central Canal; 705,000 marks for the two-ship branch canals; 356,000 marks for the one-ship branch canals; 323,000 marks for the canalizing of the Weser from Hameln to Min-

den; and 316,000 marks for the works on the Dortmund-Ems Canal, based on official statements. It is estimated that it will take eight years to construct the canal, including the time necessary for working out the detailed plans.

### THE CARRYING OF THE CANAL THROUGH SCHAUMBURG-LIPPE AND BRAUNSCHWEIG—CANALIZING OF THE WESER FROM HAMELN TO BREMEN.

In order to carry the canal through the Principality of Schaumburg-Lippe and the Duchy of Braunschweig, a treaty between these two States and Prussia will be necessary. One agreement in the contract has already been obtained, namely, that Prussia be permitted to construct the canal according to the foregoing plans (with the proviso that the Landespolizei shall inspect the detailed plans shortly to be drawn up), with the legal right to collect tolls on the canal according to the ordinary rates established in Prussia. It is also necessary that the government of Braunschweig shall connect more closely, at their own expense, the city of Braunschweig and the territory lying behind it, by means of a branch canal or a railroad.

### THE CANALIZING OF THE WESER.

The canalizing of the Weser, by means of which this river from Minden down to Bremen and up to Hameln will be open to all vessels passing on the Rhine-Elbe Canal, will increase the traffic on the canal to a considerable extent, and will especially benefit the city of Bremen. By means of it Bremen will have an approach to the network of inland waterways, the capacity of which will exceed that of the Elbe. Bremen will also be so situated as to be able to compete for the trade of the industrial district of Westphalia on equal terms with the ports on the Ems, trade with which is made possible through the Dortmund-Ems Canal.

In consequence of the great benefit which Bremen will receive from the canalizing of the Weser from Minden down, it is concluded that Bremen shall bear the expense of the work on this portion of the river, while that on the portion from Minden to Hameln shall be paid for by the States on that side, with the cooperation of the different interested parties. Prussia will share the cost of connecting the Rhine-Elbe Canal with Bremen only in so far as concerns the series of locks leading down from the canal to the Weser, besides which, after the canalizing, she will continue to pay the average cost of the maintenance of this part of the river, as in previous years. The expense of canalizing that portion of the river which runs through Braunschweig territory in the reach from Minden to Bremen will also be assumed by Bremen, while that on the portion above Minden lying in the territory of Lippe will be paid for by Prussia.

The cost of maintenance and operation will be divided in the same way. According to the present state of negotiations between Bremen, Braunschweig, and Lippe, it is to be assumed that within a short time an agreement between Prussia and these States will be consummated and laid before the Prussian Parliament.

In order that there may be no doubt as to the right of introducing navigation tolls on the canalized Weser, the consent of all the States bordering on the Weser—Oldenburg, Braunschweig, Lippe, and Bremen—will be sought and at once made public.

## THE ECONOMIC SIGNIFICANCE OF THE RHINE-ELBE CANAL.

The influence of a canal running from the Rhine to the Elbe will extend to a great part of Germany, as through it her large rivers, until now severed, will be closely united and the northeastern part of the country brought into navigable communication with the southwestern.

The conditions of the principal countries through which the canal passes or which are particularly affected by it must now be briefly considered.

## DESCRIPTION OF THE INDUSTRIAL DISTRICT.

The industrial district of Westphalia comes first under consideration, the economic condition of which has developed in such an unusual manner that it can hardly be compared to that of any other locality. A closely woven network of railroads covers the entire region; coal mine succeeds coal mine; chimneys, elevators, heaps of mine refuse (Berghalden) are everywhere to be seen. Thickly populated cities and centers of trade lie close together, humming with industrial activity. Furnaces, iron and steel works, foundaries, factories, zinc and copper smelting works, shipping wharves, and many manufactories, some of them of the largest, unite in making a picture of industrial development which can not be duplicated on the Continent, and would scarcely be found even in the rich manufacturing districts of England. In Part II, Appendix 7, of the memorial, the prodigious traffic on the railroads and the local traffic, as it was already in 1892 and in 1893, is shown in tabulated form. Since that date the traffic has greatly increased. The year 1892 was chosen, as it was the basis on which the following statements concerning the canal traffic were made:

The industrial district of Rhenish Westphalia comprises only one one-hundred-and-fiftieth of the German Empire; it is inhabited, however, by one twenty-second of the total population, and supplies the railroads with one-fourth of the entire traffic. According to the number of tons received and forwarded in the year 1897, 73,000 tons to a kilometer of railroad belonged to the Ruhr district, and only 6,800 to the rest of Germany, therefore not even a tenth part; to 1 ton kilometer area in the Ruhr district 25,000 tons, in the rest of Germany 500—that is only a fiftieth part; to one inhabitant in the Ruhr district 37 tons, in the rest of Germany 6.2 tons, or about a sixth part.

The goods shipped at the great Rhine ports of the industrial district—Ruhrort, Duisburg, and Hochfeld—taking into account the reshipping at Duisburg, in 1896 reached 10,200,000 tons, a figure which far surpasses all the inland ports of Europe. Its increase is, moreover, continual, as is shown by the following figures, which do not include the traffic on the Duisburg banks:

| | Tons. |
|---|---|
| 1875 | 2,900,000 |
| 1880 | 3,500,000 |
| 1885 | 4,500,000 |
| 1890 | 6,200,000 |
| 1894 | 7,300,000 |
| 1896 | 9,700,000 |

This increasing movement of merchandise owes its rise mainly to the coal mines, which not only export a great quantity of fuel in the form of coal, coke, and briquets to all parts of Germany and beyond, but also offer an inducement to many highly developed industries to establish themselves in that locality, among which the smelting and working of iron are the most important.

The coal mines of the district are indicated in Part II, appendix 6, by circles, the area of which corresponds to the mines worked in 1898. If one mine contains several pits or shafts they are all counted as one, if their single circles would otherwise fall within one another. The map of the mines shows the closely crowded coal fields, their geographical division, and the importance of certain works.

The output in the Ruhr district, according to authentic documents, amounted in round figures to:

| | Tons. | Men employed. |
|---|---|---|
| 1840 | 1,000,000 | 9,000 |
| 1850 | 2,000,000 | 13,000 |
| 1860 | 4,000,000 | 29,000 |
| 1864 | 8,000,000 | 39,000 |
| 1870 | 12,000,000 | 51,000 |
| 1874 | 16,000,000 | 84,000 |
| 1880 | 22,000,000 | 80,000 |
| 1884 | 28,000,000 | 101,000 |
| 1890 | 35,000,000 | 128,000 |
| 1892 | 37,000,000 | 144,000 |
| 1894 | 41,000,000 | 153,000 |
| 1895 | 41,000,000 | 155,000 |
| 1896 | 45,000,000 | 162,000 |
| 1897 | 48,000,000 | 176,000 |

In Part II, appendix 8, is added a tabulated statement of the growth of the coal industry of Rhenish Westphalia.

It will be noticed that the output of coal since 1892, which is the year used as the basis for the following estimations in regard to the expected canal traffic, to 1897, or in five years, has increased 11,000,000 tons, or 30 per cent. This growth alone would, in a few years, suffice to supply the canal with a superabundant traffic.

According to computation there was in the Ruhr district in 1893 coal at hand, as far as openings were made, to the amount of 11,000,000,000 tons at a depth of 700 meters; 18,000,000,000 tons at a depth of 1,000 meters; altogether about 30,000,000,000.

At a yearly output of 50,000,000 tons the provision at hand, at a depth of 700 meters, would suffice for two hundred years, and the whole quantity of coal at present known, at double the yearly output, would suffice for three hundred years. Great Britain expects her coal fields to be exhausted long ere that. At present the shafts in the Ruhr mines go down to 1,000 meters, and it is to be supposed that in consequence of technical improvements constantly discovered that it is only a matter of time when it will be possible to work at a still greater depth.

The iron industry has kept pace with the coal production. In 1894, 4,700,000 tons of pig iron (if Luxemburg is included, 5,400,000) were produced in the whole of Germany, 2,070,000 of which, or 44 per cent, came from the industrial district of Rhenish Westphalia. In regard to finished manufactured products the Ruhr district furnishes a still larger per cent.

DIRECTION TAKEN BY TRAFFIC.

In examining the road over which must pass the goods drawn from the industrial district itself, and those brought to it from other places, we must first consider the mighty stream of trade which is carried by the railroads to the ports on the Rhine, and from there transferred to the Rhine itself. The imports and exports of Ruhrort, Duisburg, and Hochfeld, from and to the Ruhr district proper, amounted, in round numbers, in 1897 to 12,000,000 tons, of which 8,000,000 tons were coal; iron, 700,000 tons; stone, 400,000 tons; iron ore, 1,000,000 tons; grain, 300,000 tons; wood, 300,000 tons; most of which was either taken from or to the Rhine.

Moreover, the railroads carried from the Ruhr district of coal and coke alone—

| | Tons. |
|---|---|
| To the provinces on left bank of Rhine | 2,800,000 |
| To Lothringen | 900,000 |
| To Grand Duchy of Hesse | 150,000 |
| To Bavaria | 300,000 |
| To Luxemburg | 900,000 |
| To Belgium | 700,000 |
| To Holland | 2,350,000 |
| Total | 8,100,000 |

In Part II, Appendix 9, is added a comparative table, prepared by the chief mining office of Dortmund, of the coal, coke, and briquettes taken from their district in 1897, and which contains a somewhat higher estimate. The variation comes about from the fact that the district taken by the chief mining office for comparison comprises a larger territory than that considered in the Ruhr district.

The iron ore carried by the railroads in the Ruhr district in 1897 amounted to—

| | Tons. |
|---|---|
| From Lothringen | 230,000 |
| From Luxemburg | 380,000 |
| From Belgium | 30,000 |
| From Holland | 560,000 |
| Total | 1,200,000 |

The commercial district here chosen possesses in coal and iron ore alone a railroad traffic of more than 9,000,000 tons, which, together with the 12,000,000 tons of freight carried between the Ruhr ports on the Rhine and the industrial district, gives 21,000,000 tons, a great part of which is of such nature as would naturally fall to the canal.

The trade of the industrial district toward the east, though not so large, is also of great importance, especially toward those places through which the canal passes. In this respect the provinces of Hanover, Oldenburg, Braunschweig, etc., come especially under consideration, as well as the district under the jurisdiction of Magdeburg and the Duchy of Anhalt.

In the year 1897 the above-mentioned States drew from the Ruhr district—

| | Tons. |
|---|---|
| Coal and coke | 3,150,000 |
| Iron and ironware | 250,000 |
| Fertilizers (mostly artificial) | 90 000 |

The entire trade of the Ruhr district between the Rhine and Ruhr ports on the one side and the above-mentioned States on the other in 1897 was 3,600,000 tons exports and 500,000 tons imports. The

imports consisted mainly of wood, iron, potatoes, flour, and salt. To this is to be added the exchange of goods between the Ruhr district and Bremen, in consequence of the canalizing of the Weser, and with the commercial district in the east. As a sign of the quantity of freight to be procured here for the waterway we will merely cite that in 1897 650,000 tons of Westphalian coal and coke were carried to the ports on the Weser by the railroads.

The principal reason for the much greater amount of traffic to the west is that in the west the Rhine, with its cheap rates and great carrying capacity, is used for transportation. This river forwards a great quantity of freight inland, toward the southwest, and also to the large seaports, and at the same time contributes greatly to the general development of commerce, manufactory, and trade. Toward the east and toward the German seaports the same means of communication does not exist. The completion of the Dortmund-Ems Canal in the near future will furnish an outlet for only a part of the industrial district.

In the territory through which the Central Canal passes one also finds a comparatively lively trade, which would be increased by large centers of trade and various business improvements of considerable extent. The principal cities here are Hanover, Linden, and Magdeburg; besides Osnabrück, with the iron and steel works of the Georgs-Marien mining and smelting union; Minden, at the junction of the Weser; the highly developed agricultural and industrial district between Hildesburg and Braunschweig; the Ilseder smelting works and the Peine rolling mills at Peine; and finally the province of Saxony, with its important agricultural interests, its sugar industry, and the potash mines at Stassfurt. Added to this is the great territory which will be opened up through the canalizing of the Weser with its chief city, Bremen, and Bremerhafen at one end and Hameln at the other.

The present trade between the country west of the Elbe on the Rhine-Elbe Canal, especially the industrial district of Rhenish Westphalia and the provinces lying east of the Elbe, is considerably smaller. Only the province of Brandenburg and Berlin have any important relations with the industrial district, namely, 500,000 tons imports and 80,000 tons exports. The lack of a waterway has here, apparently, had a paralyzing effect, as from that circumstance it has come about that between Berlin and the industrial district of upper Silesia, which is not so important and is exactly as far distant, there exists a railway trade which is five times greater in tonnage than that between the capital of the Empire and the Ruhr district. The trade between the latter and the eastern provinces is also very insignificant, and moreover most of it goes in a roundabout way by sea; and yet it is especially to be desired that the agricultural east and the industrial west should exchange their products.

If one glances over the details laid down as follows one grasps a general idea of the economic condition of the country affected by the Rhine-Elbe Canal.

1. The industrial district of Rhenish Westphalia possesses an important and preponderating part of the entire trade of Germany in such commodities as are specially adapted to water transportation.

2. The industrial district is at present in the throes of a lively development which, if the favorable conditions are maintained and further improved, undoubtedly will continue. The possibility of such a continuance is assured by the rich supply of coal in that region.

3. There is already a heavy stream of trade both east and west from the industrial district along the line which the canal will take. In the west the favorable influence of the Rhine, which forms a cheap waterway inland and to the sea, is very noticeable, while the lack of a similar navigable waterway toward the eastern part of the country and the ports on the North Sea has prevented a like development of trade in that direction.

According to the above, the general trade conditions present a most favorable outlook for the economic results of a canal from the Rhine to the Elbe; in the meanwhile careful investigations have been made in regard to all questions that especially concern the canal traffic to be expected.

### TRAFFIC ON THE RHINE-ELBE CANAL.

Although it is not possible from such investigations to predict with certainty the extent of the traffic which would fall to the canal, nevertheless it is evident that the greatest possible clearness in the statement of facts relating to the subject is of the highest importance in deciding as to the value of the proposed canal. As far as the statistics in what follows are concerned they are gathered from official sources. Perfect accuracy as to the figures in the conclusions drawn, however, can not be claimed. The calculations given rest in the essential facts upon estimations based upon the present trade conditions. As these are constantly changing, their condition in the future, after the opening of the canal, which would not be for more than ten years after the investigations were made, can not be foreseen. The rate of the tolls on which the estimates are based rests on provisional assumptions, the correctness of which in regard to the amount of trade, and especially the cost of water and rail freight at the time of the completion of the canal, must be carefully inquired into. In spite of these provisos in regard to the direct and practical value of these calculations, they offer a valuable basis for the critical examination of a canal as to its fitness for traffic and revenue.

The investigation has extended to inquiries as to the traffic to be expected on the canal, and the saving to certain kinds of traffic in the cost of freight; also to the revenue to be looked for from canal tolls and to the probable falling off in railroad transportation.

Before these all-embracing questions can be taken up, however, certain fundamental facts and suppositions as to the kind of traffic, the amount of the cost of navigation, canal tolls, additional charges, etc., must be determined upon in joint deliberation with railroad and waterway authorities. These will next be briefly discussed.

To begin with, the investigation had only the present trade, now dependent upon the railroads, from which to draw its conclusions in regard to the average yearly increase in traffic up to the time of the opening of the canal and its subsequent development.

The great amount of new traffic to be expected is not taken into account in the investigation, consequently the results obtained possess a proportionately high degree of certainty, as overestimation in the real existing traffic is impossible, and the new traffic to be looked for upon the opening of the canal is considered as a reserve plea in support of a canal and as proof that the railroads will not be injured.

The cost of transportation arising from the using of the Rhine-Elbe Canal must first be estimated, and is divided into (1) the cost of

navigation proper, (2) the cost of additional expenses, (3) the cana tolls.

As there has never been a canal of such great dimensions for s long a distance, and so favorably situated in regard to the numbe of its locks, etc., there is no direct experience as to what the cost o navigation on the Rhine-Elbe Canal will be. Moreover it can no now be foreseen what the state of circumstances will be at the tim of the completion of the canal—that is, in about 1908. According to the detailed investigation here given, the results of which hav been tested by comparison with the actual freight paid on the river and existing canals, it would be fair to take the actual cost of navi gation at an average of 0.5 pfennig to the ton-kilometer. In orde not to reckon too favorably as to the canal traffic, this rate of 0. pfennig the ton-kilometer is only used for the consignments of coa destined to the Central Canal for further shipment; as for the rest a uniform rate of 0.7 pfenning per ton-kilometer is taken.

For additional expenses 20 pfennigs a ton is calculated for charge (Spesen); 30 pfennigs a ton for double harbor dues; 10 pfennigs fo the loading of coal from the mines or the railway car into the ship and from 22 to 100 pfennigs the ton for a possible transshipment o cargoes from the boat to the railway or to another boat in case th goods pass over a waterway where different sized ships are used moreover, in certain cases, harbor charges (Hafenfrachten) as wel as insurance charges on the cargo; and if the place of import o export does not lie on the waterway the railroad charges accordin to the regular tariff rate are added.

The rate of canal tolls, moreover, is an important factor in th investigation. The canal is divided into two parts in regard to tolls in the western part they are high, in the eastern low. The wester part of the canal for a short distance from the Rhine to Herne woul cost so much to build that, in spite of the lively traffic expected, high canal toll will be necessary in order to cover the expense o interest and maintenance. On the eastern part, from Bevergern t the Elbe, a lower toll is all that will be required on account of a com paratively lower cost of construction. There is also a great differ ence as to whether the traffic uses the artificial waterway for only short distance, as on the Dortmund-Rhine Canal, and then turns o to the Rhine, therefore during by far the longest distance goin entirely free of toll; or whether, as is the case with the traffic goin toward the east, it uses a waterway burdened with tolls for the entir distance. The former freights are able, naturally, to pay a highe uniform rate the ton-kilometer than the latter, as the tolls durin the short passage on the canal would be comparatively insignificant and the gain from the direct junction with the Rhine, compared t the present necessity of an intermediate railway transportation, pro portionately great.

In the investigation the higher tolls are placed on (*a*) the traffi between the Rhine on the one side and the industrial district on th other, as well as in the industrial district itself, though only on th part of the canal from Hern to Laar; whereas the lower tolls, desig nated under (*b*), are reckoned on for the traffic on the near by Dort mund-Ems Canal; (*b*) the lower tolls are placed on all the remainin traffic, especially on that between the Rhine and the industrial dis trict on the one side, and the Dortmund-Ems Canal north from th Dortmund branch canal, and on the Central Canal.

It is assumed that there will be three kinds of freights received, which will correspond, more or less, to the classification of freights on the railroads, namely: First class, corresponding to the special rate 1 of the railroad, 2 pfennigs per ton-kilometer; second class, corresponding to the special rate 2 of the railroad, 1.5 pfennigs per ton-kilometer; third class, corresponding to the special rate 3, and the still lower exceptional rate for heavy freights, 1 pfennig per ton-kilometer.

If, according to the analogy of the traffic of other waterways, it is assumed that about 10 per cent of it will fall to class 1, 10 per cent to class 2, and 80 per cent to class 3, one gets an average rate per ton-kilometer of $10/100.2 + 10/100.1.5 + 80/100.1 = 1.15$ pfennigs.

Moreover, it is assumed that the rate of the lower tariff should be one-half as high as that of the Dortmund-Rhine Canal, namely: First class, 1 pfennig per ton-kilometer tariff; second class, 0.75 pfennig per ton-kilometer tariff; third class, 0.50 pfennig per ton-kilometer tariff; or an average of 0.575 pfennig per ton-kilometer.

Without taking into account the additional expenses, which, however, it is especially desirable should be ascertained, the assumptions on which the calculations as to tariff and revenue are based, give the following total cost of transportation per ton-kilometer on the Rhine-Elbe Canal:

| | Class 1. | Class 2. | Class 3. | Coal. |
|---|---|---|---|---|
| | *Pfennigs.* | *Pfennigs.* | *Pfennigs.* | *Pfennigs.* |
| Dortmund-Rhine Canal | 2.7 | 2.2 | 1.7 | ..... |
| Central Canal | 1.7 | 1.45 | 1.2 | 1.0 |

In the same way it may be added that the railway freight rates of the first, second, and third class tariffs, without counting the cost of forwarding, amount to: Class 1, 4.5 pfennigs; class 2, 3.5 pfennigs; class 3, 2.6 pfennigs or 2.2 pfennigs, and that, at the lowest special rate current at the present time, including the cost of forwarding, a rate of 1.50 pfennigs per ton-kilometer would be charged on the Rhine-Elbe Canal for a medium distance of transportation; say, about 300 to 350 kilometers.

In case the freight does not go all the way on the Rhine-Elbe Canal, but uses also other waterways, the usual navigation tolls on the same are added.

As the cost of storage, loading and unloading, and other accessory expenses are comparatively high, water transportation is generally only used for long distances. In the calculations in regard to traffic and revenue all such freights are excluded as are not sent a distance of (*a*) 40 kilometers, if the shipping point and the place of destination both lie on a navigable waterway; (*b*) 70 kilometers, if only the point shipped from or the place of destination lie on a navigable waterway; (*c*) 160 kilometers, if neither the shipping point nor the point of destination lies on a navigable waterway.

After the amount of the cost of navigation has been estimated according to this method, the boundaries of the territory affected by the Rhine-Elbe Canal and its branches must be roughly defined. In this district the total transportation for the fiscal year 1892, which was carried in whole carloads of at least 10 tons, under special rates, and which, according to the direction taken, the character of goods, the weight, class, freight paid, and the Prussian state railroad's share in the latter, might possibly have been able to use the Rhine-Elbe Canal, was ascertained.

In the same careful manner, on the basis of the above assumptions, it was determined what would have been the charge for each of the freights if using the canal. Then all freights which would have made no use of the canal were struck off, and out of those which could have been transported on the waterway at cheaper cost, all those which would make a saving of less than 15 per cent of the railway charges separated, as it would seem that, in general, an abatement in cost of less than 15 per cent would not be sufficient inducement to turn the goods from the railway to the waterway. The remainder showed the freights which are to be considered as using the waterway. Corresponding estimates are found by reckoning the per cent of the proportion in which the use of the railway by piece goods and the ordinary carload class of goods stands to the total amount of freight carried on the railroad under the special and exceptional tariffs.

The year 1892 is taken as basis, as the investigation was already begun in 1894. Since then there have been essential changes in regard to railway freights, for, as the tariff for raw stuffs of the special third-class tariff has been extended to coal, ores, and wood, the consequent undervaluation of freight should be considered in any new calculations. The new railway rates, therefore, given in the present calculation, concerning traffic, loss of freight, etc., are the same as though they had been made in the year 1892.

Finally, it is assumed that, of the total traffic reckoned as falling to the canal, a certain part would continue to be carried by the railroads, as many small articles and goods requiring speed would choose the latter way in spite of the higher cost, and also because the canal can only be used during about ten months of the year. This share of the traffic remaining to the railroads is reckoned as 20 per cent for the Central (Bevergern to the Elbe) and 40 per cent for the Dortmund-Rhine Canal, so that only 80 per cent or 60 per cent of the freight suitable for water transportation is considered in the calculation as canal freight.

In view of the constantly increasing movement of goods, which has steadily continued since 1892 (the year taken as the basis in the investigation) up to the present time, it would not be right to take the traffic of 1892 as basis for the amount of revenue the canal would be capable of producing. For many successive years an average yearly increase of 3 per cent has been observed in the traffic of the railroads. The territory through which the Central Canal would pass has at least this average, since in the industrial district of Westphalia the increase in traffic has been over 5 per cent. Therefore a yearly increase of from 3 per cent to 5 per cent is also assumed in traffic up to the time of the final completion of the canal and for the first ten years after, which increase seems the more probable as the cheaper way of transportation would be an important factor in the development of new traffic.

It may therefore be assumed that by means of this very arduous and painstaking method a good idea is gained of the traffic which may be expected on the canal.

The canalizing of the Weser was not considered until after the investigation in regard to railway traffic was already concluded. It was nevertheless possible to determine in a more simple manner, and one better suited to the purpose, the important influence which the canalizing of the Weser would have upon traffic and revenue. This investigation was limited to certain kinds of goods (coal, grain, sugar,

fertilizers, iron ore, rice, cotton, and wood) and considered only the present traffic of the upper Weser and a small side trade between Hamburg and the upper Elbe and Berlin. All other freights are not counted and remain as a balance against any possible overvaluation. The entire investigation was carried on with the concurrence of Bremen, as well as under the competent direction of the Prussian railroads.

Negotiations in regard to the serious question concerning the collecting of tolls and the regulation of tariffs have already taken place between Prussia and Bremen. The decision, however, is temporarily suspended. The revenue upon which the calculations are based are laid chiefly upon propositions made by Bremen. According to them three classes of tariffs are assumed for the Weser also, in which, however, the goods are somewhat differently divided from those on the Central Canal—i. e., (*a*) class 1 containing all grain and piece goods, at 0.75 pfennig per ton-kilometer, (*b*) class 2 containing all goods of the first and second special railroad rates and of the higher carload class, at 0.5 pfennig per ton-kilometer, (*c*) class 3, including all goods under special railroad rate 3 and the cheaper exceptional rates, at 0.25 pfennig per ton-kilometer.

As doubts have arisen, however, as to whether the present traffic on the Weser will be drawn into the canal, there should be corresponding deductions made in calculating the revenue.

The traffic of the entire Rhine-Elbe Canal calculated in the way described above would be, in 1908, about as follows:

TABLE I.—*The financial condition of the Rhine-Elbe Canal according to the calculated traffic of 1908.*

| (1) | Canal freight. | | (4) Loss in gross receipts of railway. | (5) Revenue from canal tolls. | | | |
|---|---|---|---|---|---|---|---|
| | (2) Tons. | (3) Ton-kilometers. | | Dortmund-Rhine Canal. | Dortmund-Ems Canal. | Central Canal. | Total. |
| 1. Dortmund-Rhine Canal | 5,505,000 | 201,000,000 | *Marks.* 29,408,000 | *Marks.* 1,819,000 | *Marks.* 247,000 | *Marks.* | *Marks.* |
| 2. Central Canal including the Weser from Hameln to Minden: | | | | | | | |
| (*a*) Without canalizing of Weser | 3,934,000 | 1,253,000,000 | 43,566,000 | 165,000 | 1,886,000 | 5,155,000 | |
| (*b*) The traffic brought about by canalizing the Weser | 1,945,000 | 324,000,000 | 5,827,000 | | 294,000 | 1,498,000 | |
| Total Central Canal | 5,879,000 | 1,577,000,000 | 49,393,000 | 165,000 | 2,180,000 | 6,653,000 | |
| Total Rhine-Elbe Canal | 11,389,000 | 1,778,000,000 | 78,801,000 | 1,984,000 | 2,427,000 | 6,653,000 | 11,064,000 |
| | | | | | | *Including canalizing of Weser from Hameln to Minden.* | |
| Share of Prussian State Railway | | | 66,966,000 | | | | |
| Yearly cost of care and operation amount to | | | | 359,000 | 37,000 | 1,483,000 | 1,879,000 |
| Net revenue | | | | 1,625,000 | 2,390,000 | 5,170,000 | 9,185,000 |
| Building capital | | | | 45,000,000 | 4,000,000 | 212,000,000 | 261,000,000 |
| Revenue gives an interest on the capital of | | | | 3.6 | 60 | 2.4 | 3.5 |
| Amount necessary for 3 per cent interest on capital | | | | 1,350,000 | 120,000 | 6,360,000 | |
| Therefore surplus or deficit in revenue for payment of 3 per cent interest | | | | | | [a] 1,190,000 | |

[a] Deficit.

Total surplus, 1,355,000 marks.

According to this table the receipts of the first year would cover not only the cost of care and operation, but would also pay an interest on the cost of construction as estimated in the present calculation, namely:

| | Per cent. |
|---|---|
| (*a*) For the Dortmund-Rhine Canal | 3.6 |
| (*b*) For the completion of the Dortmund-Ems Canal, in round numbers | 60 |
| (*c*) For the Central Canal, including the canalizing of the Weser from Hameln to Minden | 2.4 |

while the interest on the total cost of construction, a sum of about 261,000,000 marks will be at the rate of 3.5 per cent, therefore at a higher per cent than the present rate of interest on government loans.

It must, however, be taken into consideration that in the first year the traffic would not be transferred from the railway to the waterway to the full extent reckoned; rather does a new way of transportation require a certain length of time to develop. The government and construction inspector, Symphner (*der Regierungs und Baurath Symphner*), entrusted with the drawing up of the calculations as to traffic, assumed that in the first year only 30 per cent of the traffic will go over from the railway to the canal, and that the change in transportation will not reach its full extent for ten years. The railways, however, affirm that by the first year 73 per cent will go over, and that this will reach its full extent in a few years.

According to the estimations made by Symphner the traffic for 1908 would be as follows:

TABLE II.—*Financial condition of Rhine-Elbe Canal according to the expected traffic in 1908 (30 per cent of the calculated traffic).*

| (1) | Canal traffic. | | (4) | (5) Revenue from canal tolls. | | | |
|---|---|---|---|---|---|---|---|
| | (2) Weight. | (3) Ton-kilometer. | Loss to railroads in gross receipts. | Dortmund-Rhine. | Dortmund-Ems. | Central. | Total. |
| | *Tons.* | | *Tons.* | *Marks.* | *Marks.* | *Marks.* | *Marks.* |
| 1. Dortmund-Rhine Canal | 1,652,000 | 60,000,000 | 8,822,000 | 546,000 | 74,000 | ..... | ..... |
| 2. Central Canal, including canalizing of Weser from Hameln to Minden | 1,925,000 | 488,000,000 | 14,818,000 | 49,000 | 654,000 | 2,031,000 | ..... |
| 3. Total Rhine-Elbe Canal | 3,577,000 | 543,000,000 | 23,640,000 | 595,000 | 728,000 | 2,031,000 | 3,354,000 |
| Share of the Prussian state railroads | ..... | ..... | 20,089,000 | ..... | ..... | ..... | ..... |
| | | | | | | *Including canalizing of Weser from Hameln to Minden.* | |
| Yearly cost of care and maintenance | ..... | ..... | ..... | 359,000 | 37,000 | 1,483,000 | 1,879,000 |
| Net revenue | ..... | ..... | ..... | 236,000 | 692,000 | 548,000 | 1,475,000 |
| Revenue gives an interest on capital of | ..... | ..... | ..... | *Per cent.* 0.5 | *Per cent.* 17.3 | *Per cent.* 0.3 | *Per cent.* 0.6 |

According to this table the condition of the revenue at first would not be as favorable as according to the preceding table. The payment of the 3 per cent interest on the cost of construction, required of the Dortmund-Rhine and the Central canals, as well as the cost

of care and operation, would be at once fully paid; the Dortmund-Ems Canal, however, would be the only one to immediately obtain a considerable surplus over the cost of maintenance and interest on the capital. Meanwhile the deficit to be at first expected on the Dortmund-Rhine and the Central canals would gradually be changed to the surplus which the calculated traffic would eventually give.

If one assumes that the increase of from 3 to 5 per cent in the traffic will continue after the opening of the canal, the receipts in the eleven years would have so increased that even on the Central Canal the interest on the capital would be fully covered, and also a constantly growing surplus be obtained, the same as on the other parts of the Rhine-Elbe Canal.

In column 5 of Tables I and II it can be seen that the Dortmund-Ems Canal may expect a large revenue in consequence of the construction of a through canal from the Rhine to the Elbe. Considering the revenue which the traffic on the Dortmund-Ems Canal alone furnishes, it is thought that in the first year these receipts would exceed 600,000 marks.

The investigation has also considered the question as to whether, from an economic point of view, the construction of the proposed branch canals is advisable. It was decided that the advisability of the branch canals to the Weser at Minden, to Linden, and to Magdeburg need not be mathematically proven, as it would be impossible to abandon the idea of connecting the canal with the Weser, or with the principal manufacturing places, or with Hanover, or with Magdeburg. The cost of the short branch canal to Lehrte and the extra cost of making the aqueduct from the Leine navigable as far as the industrial towns of Döhren and Wülfel would be so small that the economic advantages to be obtained need no especial proof. The branch canals to Osnabrück, Hildesheim, and Peine were also carefully inquired into, and it was decided that all three of these canals should be built—but in the cheapest and most simple manner—therefore for one ship, with occasional places for passing. The locks and the height of the bridges, however, must measure the same as on the main canal, so that there need be no limit in the traffic on account of the size of the ships. In this way it is shown that for all three branch canals the interest and cost of maintenance would be covered by the extra tolls on the main and branch canals. To be sure a considerable part of thses tolls would be collected on the main canal, even should the branch canals not be built, as the freights would doubtless use the first as far as the nearest shipping port to the desired destination; but it must not be forgotten that the direct water communication to the principal town to be connected by the branch canal will increase the incentive to use the waterway, and will also favor the development of new industries and new transportations, so that from the branch canals alone a lively increase in the traffic of the territory through which the canals will pass may be fully counted upon. The branch canals are the arteries which nourish the traffic, and one of their principal objects will be to favor the much to be desired decentralization of industry, and to make other territories besides those lying on the main canal beneficiaries of the cheap waterway. It is recommended, therefore, to establish a direct water communication between the main canal and the important and growing cities in question, for otherwise the guaranties demanded of the provinces and parties benefited would hardly be forthcoming.

## EFFECT OF THE CANAL ON THE REVENUE OF THE STATE RAILROAD.

It stands to reason that the new canal which will run through a district with a highly developed railway traffic must exercise a powerful influence over the revenue of these railroads. It will also be affirmed by the railroads that this influence will make itself felt very soon after the opening of the canal, as it has to do with a quantity of goods which would, as a matter of fact, have been entirely moved by the railroad and which will be drawn away in part from the railroad to the waterway because of the cheaper rates. The experience of railways has taught that a shipper after the opening of a competing way of transportation immediately seeks out the cheapest route, provided that its carrying capacity is sufficient. In the foregoing cases, moreover, it chiefly concerns goods which are sent in large quantities by comparatively few shippers, on which naturally the inducement to save on freight is all the stronger. Moreover, the fact that the western coal and iron industries will in the time intervening between now and the opening of the canal have completed by themselves, or through others, the preparations necessary to transfer their present freight to the new waterway will greatly affect the railway receipts. So far, however, as concerns the building of works which can only be begun after the canal is in progress of construction—such as the preparing of large shipping ports—it can hardly be expected that at the time of the opening of the canal they will be far enough completed to answer in full the needs of the shippers. It is difficult, therefore, under these circumstances to determine beforehand with any degree of certainty the date at which the waterway will have drawn over its full share of the traffic belonging to the railroads in 1908. In the meanwhile one will not be very greatly in error if one follows the opinion of the local railroads, i. e., that in the first year of the canal 75 per cent of the full share to be transferred will go to the waterway, and in the second year the remainder.

It is otherwise with the traffic which will be newly created in consequence of the cheaper water transportation and which naturally can then first be developed. In the following table the entire effect which the canal will have upon the revenue of the railroads is calculated, and it is left to one's individual judgment to decide whether the full effect of the canal will be felt in the second or third year.

*Decrease in the railroad traffic and revenue in 1908.*

| (1) | (2) | (3) | | (4) | | (5) | |
|---|---|---|---|---|---|---|---|
| Canal. | Number of tons. | Freight carried by— | | Receipts for new freights after opening of canal on— | | Gross loss, deducting new receipts (4). | |
| | | German and foreign railways. | Prussian state railways. | All railways. | Prussian state railways. | All railways. | Prussian state railways. |
| Dortmund-Rhine Canal | 5,505,000 | 34,436,000 | 21,324,000 | 5,028,000 | 3,113,000 | 29,408,000 | 18,211,000 |
| Central Canal | 3,934,000 | 50,137,000 | 48,184,000 | 6,571,000 | 5,256,000 | 43,566,000 | 42,928,000 |
| Canalizing of Weser from Hamelin to Bremen | 1,945,000 | 6,300,000 | 6,300,000 | 473,000 | 473,000 | 5,827,000 | 5,827,000 |
| Total | 11,384,000 | 90,873,000 | 75,808,000 | 12,072,000 | 8,842,000 | 78,801,000 | 66,966,000 |

The foregoing calculations are correct in so far as they are drawn from the invoices of the freight really carried by the railroads. It is not necessary to explain, however, that the accuracy of the figures can not be guaranteed, as a number of determining factors can not be ascertained at the present time, and it was necessary, therefore, to depend upon general estimations based on general experience, and having especially in mind the district in question. According to the foregoing table, a yearly falling off of 67,000,000 marks in the gross receipts of the state railroads is to be counted on. This sum must be reduced to the amount of net loss; that is, the sum which the railroads really save from a reduction in the expense of carrying must be deducted from the gross loss. As the passenger traffic on the railroads in question remains unchanged, a decrease in the cost of general management is not to be expected; therefore there will be a saving in expense only in the cost of maintaining and repairing the tracks, in the cost of train power, in the repairing of locomotives, in the maintenance of freight and express cars, in the repairing of freight and express cars, in the expense of service and wages, in the expense of dispatching and shifting of goods, as well as, finally, in the expenses which come under claims 6 and 12 of the statement of expenditures (*Ausgabeetat*). As to the possible saving in the service department, it must be mentioned that since the Government has managed the railroads certain regulations have been made which, all things included, give a saving of 14,000,000 marks. According to this, the profits of the state railroads would be reduced about 53,000,000 marks yearly. This loss would be greatly increased if in the future considerably lower rates than those on which the calculations are based should be charged.

To counterbalance these losses are certain advantages to be looked for by the railroads, which unfortunately can not be accurately figured out, but which nevertheless will have an important bearing on their condition. In consequence of the need of exchange between certain parts of the country, the cheaper cost of transportation on the canal will bring about a great amount of freight of small value, the shipping of which over long distances on the railroads has hitherto been impossible. It is also expected that these freights will be transferred at various points to the railroads and will bring them a new traffic. It may further be assumed, upon good grounds, that the waterway will gradually tend to increase and to extend existing industries, and will arouse new ones, the fruits of which will be felt by the connecting railroads. Experience has taught that wherever a navigable waterway of adequate dimensions and equipment passes through a country the railroads running through the district have enjoyed an increase in their traffic. The hope may therefore be raised that the loss in receipts which, for a while, must inevitably accompany the new canal system will in a short time not only grow less, but be changed into an even greater net revenue. It must, right here, be emphatically stated that, although it is of the utmost importance to the railroads to use to the full their independence in making tariffs to their own interest, even after the building of the canal, it is nevertheless utterly impossible for the state railroads to counterbalance, by means of discriminating freight charges, any prejudice to certain districts or enterprises which may follow the establishment of the canal.

It would be of the greatest advantage to the future welfare of the railroads which pass through the industrial district, leading either to or from it, if a new waterway of the greatest possible carrying capacity would assume the transportation of all bulky freight.

It is well here to call to mind the prosperous development which the Ruhr district has enjoyed during the last decade. The railroad traffic in that region has risen from about 43,000,000 tons in 1892 to about 62,000,000 in 1897, which means an increase of 42 per cent in five years. The mineral riches and the natural advantages of the Ruhr district not only make a further like increase possible but the intelligence, achievements, and capital of the population give the hope of a still greater development, provided that general conditions of business do not take an unfavorable turn. Because of the exceedingly heavy traffic which the existing railroads have to carry, even at the present time, and because of the impossibility of increasing the carrying capacity of certain lines, the need of not only increasing the state railroads in the industrial district but also of extending the double track on the existing lines farther into the provinces of Hanover and Saxony or else of building new roads grows daily more and more important. Under these circumstances the Government judges it right to build, at once, a waterway of ample dimensions. The railroads will then be the sooner in condition to turn to the question of better railway facilities in the industrial district, to the question of adapting the railroads to the changed conditions of traffic which, after the canal is opened, will develop in the direction north and south in place of east and west, and which will require a partial change in the stations and yards erected for the former traffic.

The objection that the waterways will not be qualified to effectively assist the railroads at all times must be faced. During the time that the canal is closed by ice the railroads will have to undertake all the transportation. In the vicinity of the Rhine-Elbe Canal frost would close navigation for about eight weeks, usually in the first quarter of the year—seldom as early as December. The traffic on the railways during the first quarter, however, is no heavier, but, on the contrary, lighter. During the last five years it has amounted, on the whole extent of the state railroads, to an average of a little over 22 per cent for the first quarter, as against 28.8 per cent for the heavier quarters. The same conditions exist in the coal and coke traffic of the Ruhr district, in which the daily demand and output is the heaviest in the fourth quarter, following which comes the third, then the first, and finally the second. The railroads will have almost no real difficulty in carrying the freight which will come to it during the first quarter of the year while the canal is closed; nevertheless, efforts will be made to induce shippers, especially in the coal trade, to move what will be needed in winter, as far as possible, during the time the canal is open. Should frost set in as early as December, which does not often occur, it would be critical for trade and for the railroads, as the heaviest traffic in the Ruhr district is in this month. The danger to the railways of an increased winter traffic, however, is not as great as the benefit to them from the wished-for assistance during the heavy traffic of the last quarter of the year. The present traffic in beets will be only partially turned over to the canal; the unfavorable condition of the water, also, during the autumn and the appearance of the Rhine fogs at the same season would in a

measure prevent the full use of the Dortmund-Rhine Canal, though the waterway would naturally be able at all times to care for the traffic in the favorable seasons of the year, would quicken the export of coal during the months of light traffic, and would thereby disburden the railroads of a part of their traffic in the heavy months.

### THE EFFECT OF THE RHINE-ELBE CANAL ON BUSINESS.

The economic benefits to be looked for from the canal spring principally from the saving in the cost of transportation. The results of the investigation described above show with certainty that this saving will be very considerable, reaching each year into the millions. In so far as this saving is not counterbalanced by the deficiency in the net profits of the railroads, it shows already in and by itself an economic gain which will, however, probably be surpassed by the advantages arising from the increase in traffic and from the awakening of new branches of industry.

Germany, which already holds a high rank among the industrial states, suffers the misfortune of having her places of production, manufactory, and consumption widely separated one from the other. In England and Belgium, for example, the iron and coal localities lie close together; no high cost for transportation, which often outweighs the value of the material, is necessary in order to bring together ore and coal for working purposes. In Germany the largest iron industries lie at a great distance from the ore, coal, and coke regions, while the nearby mines furnish either too small a quantity or one of too little value. They endeavor, therefore, to lessen economically this distance between the place of production and the place of consumption by means of lower railroad rates or by waterways.

As the whole country is a consumer of coal and iron, and the two commodities constitute more than 50 per cent of all the goods exported from Germany, it is evident that a cheaper rate of transportation for coal and iron would be to the common interest of the country. It is hardly necessary, in view of the general distribution of both of these most important products of the mine and foundry, to point out any particular branch of the industry as being especially interested. Trades which are connected with agriculture, such as distilleries, breweries, sugar manufactories, brick kilns, etc., are not the least affected by cheap fuel as well as by cheap machinery and ironware. The daily need of fuel for common household purposes makes each individual a consumer, interested in the moderate price of coal and iron. The lower cost of transportation would not benefit the consumer only, but the producer also.

The same unfavorable conditions in regard to distance prevents the transportation of the agricultural products of the farming districts to the highly developed and thickly populated industrial districts. The latter are therefore supplied with grain from foreign countries, while the surplus of German corn must seek a market abroad. Agriculture, therefore, is interested in cheap freight rates, which interest found its most striking expression in the desire for special rates on staple products.

The beneficial reaction of cheap transportation would bring about a continual increase in business and agricultural activity in all that part of the country through which the Rhine-Elbe Canal would pass;

cheap coal and cheap raw material would promote industries; cheap fertilizers would promote agriculture. A successful fighting of foreign goods in German markets, and easier competition with the same abroad, would increase the business and markets of all branches of trade. Hitherto the high cost of transportation has made it necessary for manufactories to crowd together in a small area, as close as possible to the coal mines; the canal, however, with all its connecting waterways, would offer an opportunity of spreading these industries over the whole country—of decentralizing them—and would thereby prevent an increase in those social evils which are the natural result of overpopulation in purely industrial districts. Finally, a moderate cost in transportation would awaken many entirely new industries, dealing principally with the production of those products which have hitherto been valueless.

A saving in cash expenses, an increase in the agricultural and industrial production, a decrease in the consumption of foreign goods, and a lessening of social evils are the principal advantages which a reduction in the cost of transportation would effect.

Every means, therefore, which will tend to diminish the great distances in our country should be welcome as a forward step and an additional weapon against the unavoidable competition.

A country which, like Germany, is in the fortunate position of being able to furnish the greater part of its own needs from its own raw material is, without doubt, the most independent if, at the same time, it is supplied with the greatest number of cheap ways of inland transportation, so that its separate parts are brought as closely as possible into touch with each other. Opportunity would then be offered for the continual employment and support of an immense population in one's own country.

The figures in the first calculations as to the work and revenue of the railroads were based upon the traffic then existing, and were so low that they soon increased in reality to fourteen times the amount. A like development is hardly possible when it is only a question of diverting a part of the freight from the railroad to the waterway; but it is always difficult to estimate with any exactness the growth of trade, and in any case it may be confidently expected that a considerable increase in the amount of freight and in business development will follow the reduction in the cost of transportation.

The canal freights, which are not counted in the investigation but which are nevertheless confidently to be expected, can be divided into such as have hitherto used other routes, and such as will then first be awakened. Both classes are in many cases identical, as, for instance, when through cheaper rates a different kind of use than hitherto is made possible.

To the first class belong principally agricultural products, grain, potatoes, sugar, wines, wood, etc. These goods now go by the rivers, in the eastern part, to Hamburg and the ports on the Baltic Sea, thence by sea to Rotterdam, and then up the Rhine in order to supply the needs of the west country. Other consignments go abroad, whereas they might be used in the western provinces instead of foreign products. The Ruhr district and the western parts of the country thereabouts are the chief consumers of foreign grain. The Rhine-Elbe Canal would flow from the east directly into the midst of this territory, and, passing as it would through the purely agricultural parts of

Saxony, Hanover, and Westphalia, it would assure a cheap means of transportation for its products to the places of consumption. The new canal would be connected, through the present waterways, with nearly all that part of the kingdom lyng east of the Elbe, and would reach the agricultural products of the eastern provinces through the Elbe, the Brandenburg waterways, the Oder, the Warthe, the Netze, and the Bromberger Canal.

All investigations agree that the Rhine-Elbe Canal by reason of its cheaper rates will be an effective means of obtaining higher prices for wood from the government and private forests, and especially of obtaining a wider market in the Ruhr district for the timber used in mines. Westphalia is no longer in condition to supply all of this timber; other districts, and even foreign countries, must be more and more drawn from in order to satisfy the demand. Because of the high price of transportation on the railroads the latter, namely, foreign countries, will be the most frequently drawn from. If the Rhine-Elbe Canal is constructed, however, an important part of the supply needed over and above that which the district itself could furnish would be provided for by the provinces bordering on the canal or by those lying east of it. This surplus need in the Ruhr district for the increasing output of coal (amounting to 11,000,000 tons from 1892–93 to 1897) amounted to more than 250,000 festmeters (125,000 tons), and by 1908 would undoubtedly have grown still greater.

The easier transportation of artificial fertilizers principally from the slack from the Thomas method of smelting (Thomasschlacke), salt of potash, and marl is, moreover, of special importance to agriculture. The turning of Thomasschlacke into phosphate powder has made great advances in the last ten years. For a long time efforts have been made to lower railroad rates on this commodity so as to extend its use; the low canal rates will increase the demand to a far greater extent. The same conditions prevail in regard to potash salts. The potash mines in the vicinity of the canal have given so rich a return that it is probable that before long the expense of working them will be paid off by the produce of the mines. The yearly production of the new Salzdetfurter potash works in the vicinity of Hildesheim is estimated at 150,000 tons. Finally the present marl beds in the province of Hanover and in other districts near the canal are capable of a great increase on their production. In the mines of the Ilseder smelting works near Peine, for example, there are 100,000 tons of unused marl chalk thrown away every year, whereas with a cheap water transportation it would become a valuable article for improving the calcareous district lying east of Lehrte.

According to experts' reports a much greater production of such mineral treasures may be reckoned upon. The Westphalian Mountains on the Porta, and from Voltho as far as the district of Lubbecke, contain rich quarries of sandstone, ironstone, and lime; the plains contain clay for brick making. A considerable increase in the output of the quarries of Piesberger sandstone in the province of Hanover is looked for. Other sandstone quarries, whose increased output would fall to the canal, are found in the Wiehen Mountains, in Solling, on the Deister, and Suntel; limestone quarries are found in Ith and in the Seven Mountains; and clay, gravel, and sand beds in the river valleys crossed by the canal. The Ilseder smelting works expect to

bring by way of the canal about 100,000 tons of furnace slack yearly for road building, which has hitherto found no market in the surrounding country. All these articles, which now have limited markets on account of the high cost of transportation, will be greatly benefited, and will furnish a large amount of freight to the canal.

If only general estimations are possible in respect to the new traffic then first to be aroused, it can, nevertheless, be seen from the foregoing deductions that a considerable quantity of freight, which would materially increase the traffic and raise the revenue of the canal without loss to the profits of the railroads, can be counted upon.

### DISADVANTAGES TO BE FEARED.

The Rhine-Elbe Canal, which would in general benefit not only the cities, districts, and provinces lying close to it, but also the more remote parts of the country, by means of cheaper rates and a quickening of trade, would, on the other hand, probably have a deleterious influence upon certain individual trades and business districts. These disadvantages would be so strongly dwelt upon by the parties concerned that there would be danger of forgetting the great general advantages of the canal. Every new improvement in transportation naturally brings with it a certain shifting of trade conditions, and the state can not be expected to set aside the results of these improvements by methods which would in turn be detrimental to it; rather must individual trades, districts, or parties who might possibly be injured recede before the overpowering public need of a new way of transportation, unless, indeed, they warrant special protective measures, such, for instance, as discriminating railway rates. Moreover, after careful investigation it has been shown that the injury to certain districts would in no case be as considerable as has been supposed.

Opposition to the construction of a waterway has been most noticeable in the agricultural districts, for the reason that much foreign grain and wood finds its way inland through the natural waterways; and it would not be possible, at present, on these streams, which have been improved at considerable expense, to expect reimbursement in the form of tolls from this traffic. On the other hand, the benefit of cheap river freight to agriculture, both for exporting sugar and for importing feed and fertilizers, must not be overlooked. The Rhine-Elbe Canal, however, which will chiefly promote the exchange of our own agricultural products, will have quite a different effect from that of the water courses leading from the sea inland. Only the Dortmund-Rhine Canal, and to a still greater extent the canalized Weser, will be used for the importation of foreign grain. According to careful inquiries by the government engineer, Symphner, the grain coming into the industrial district over the Rhine and the new canal will have a profit of only about 1 mark the ton; that coming over the Weser and the Central Canal, toward south Hanover, about 3.50 marks, as the highest tolls will be imposed on these transports.

There has been great fear expressed that the building of so great a canal would draw away too much labor from the agricultural districts touched by the canal. During the construction of the most important government works within the ten years past, especially during the building of the Dortmund-Ems Canal and the Kaiser

Wilhelm Canal, such evil effects were apparent only in a limited degree. The common farm hand is, in general, little inclined and little fitted for the hard labor of digging, etc.; moreover enough foreigners are to be had for the work.

Certain industries are also violently opposed to the execution of the Rhine-Elbe Canal, as they fear the increased competition of the Ruhr district in markets which they have hitherto held. The opposition has been especially strong in the brown coal district of Saxony, in the Waldenburg hard coal (steinkohl) district of lower Silesia, and in upper Silesia. The conditions concerning these districts were therefore carefully investigated.

A glance at the development of these districts shows that, as a whole, they have greatly increased during the last thirty years.

| | 1864. | 1894. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Ruhr district coal | 8,000,000 | 40,700,000 |
| Lower Silesia coal | 1,100,000 | 3,700,000 |
| Upper Silesia coal | 3,900,000 | 17,200,000 |
| Brown coal fields of the Provinces of Saxony, Brandenburg, besides Anhalt and Braunschweig | 4,900,000 | 17,500,000 |

Brown coal finds its principal market in its own district, as a great number of industries which use it have settled in the vicinity of the mines, for instance the sugar manufactories, which alone use 34 per cent of the output. Many brown coal mines are provided with works for manufacturing the coal into briquettes, which are chiefly suited for household use (though they may be used for industries) and the demand for which is constantly increasing

In order that the brown coal of Saxony, in its raw state, might hold its own against the hard coal of the west, the cost of transportation on the former, because of its inferior value for heating purposes, should be at least a third less than that of the latter. Therefore the fitness of brown coal for exporting in its raw state is limited. The chief mining office considers the brown coal mines at Magdeburg the ones chiefly threatened by the Westphalian coal. The expected loss in sale in these works is estimated at one-seventh of the amount forwarded, or at about 500,000 tons. For the brown coal fields of Merseburg a certain depression in price is expected, as the coal from Magdeburg, in part supplanted in the markets it has hitherto held, will seek to penetrate into the market places of the other mines. A universal drop in prices will take place also, as the Westphalian coal will be able to reach the common markets, especially those of Berlin and Magdeburg, more cheaply than formerly.

The consumption of brown coal briquettes, which come from the district of the chief mining bureau, has increased in Berlin, according to present information, from 46,000 tons in 1875, to 760,000 tons in 1894; the increase corresponds to about 2,000,000 tons of raw brown coal. From a small beginning the brown coal has thus, within twenty years, conquered this important market in one city. It is not likely that this development would be injured by the building of the Rhine-Elbe Canal, as the Westphalian hard coal is not fit to take the place of brown coal briquettes for house use. It is much more likely that in consequence of the canal the briquettes would be able to gain new markets, for instance the important town of Hanover.

Accordingly, the injury which the brown coal industry fears must be overestimated; particularly as the easier transportation of the Silesian hard coal to Berlin, in consequence of the improved waterway to Silesia have not, as far as known, worked any harm to the briquette industry.

The hard coal of Silesia fears also the increased competition of the Ruhr coal; in this two separate districts, geographically speaking, come under consideration, the lower Silesian or Waldenburg district, and the upper Silesian district. The Waldenburg district finds its markets chiefly in the parts of Silesia and Brandenburg lying near the mines, in the eastern part of the Kingdom of Saxony, and in Bohemia. The coal from upper Silesia commands the markets of a large part of Silesia, Brandenburg, Pomerania, east and west Prussia, as well as Posen, besides being sent to Russia, Austria, and to the countries on the Danube, and even to the Elbe above Magdeburg. It is supposed that by the construction of the Rhine-Elbe Canal the export to Berlin, to the province of Brandenburg, to the district of Magdeburg, to Anhalt, to the districts of Merseburg and Erfurt, to Thuringia, and to the Kingdom of Saxony will be endangered.

Meanwhile, however, after the canalizing of the upper Oder is completed, and the great navigable waterway is opened to Breslau, and after the tariff for raw stuffs has been extended to coal destined to the shipping ports on the Oder, and further freight reductions on the traffic from Waldenburg to Berlin have appeared, the fear that Ruhr coal might drive Silesian coal from the markets of Berlin, Brandenburg, etc., loses, in reality, all weight.

Careful investigations have also been made in regard to the injury to the iron industry of upper Silesia. At the present time upper Silesia, Peine (the Ilseder smelting works), and the Ruhr district all compete in the same common markets. The production of each one of them is also constantly increasing.

The increase in the production of pig iron is as follows:

| | 1864. | 1894. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Ruhr district | 250,000 | 2,070,000 |
| Peine (Ilse works) | 14,000 | 150,000 |
| Upper Silesia | 120 000 | 510,000 |

The increase in the production of manufactured and half manufactured iron articles (der Schweiss u. Flusseisen Werke) was:

| | 1864. | 1894. |
|---|---|---|
| | *Tons.* | *Tons.* |
| Ruhr district | 260,000 | 2,500,000 |
| Peine (1884) | 40,000 | 140,000 |
| Upper Silesia | 80,000 | 490,000 |

After the construction of the Rhine-Elbe Canal the Ruhr district will, of course, be able to send its iron manufactured goods to Berlin and the east at a cheaper rate; Peine also—whose production, however, will always remain limited—will receive Westphalian coal and coke over the cheaper waterway, and will also be able to send finished iron goods cheaper by ship to the east.

But upper Silesia, in consequence of the new waterway from Cosel to Berlin, whose effect will be more and more apparent, will also enjoy a great reduction in the cost of freight.

In consequence of all this, therefore, the following conclusions have been arrived at in regard to the financial and economic value of the canal:

1. That the canal will probably be in condition to maintain itself at its own expense, as well as to pay interest on, and gradually pay off, the capital invested.

2. That while the loss in the railroad receipts will indeed be great, yet it will presumably be counterbalanced by the increase in traffic caused by the canal.

3. That foreign productions, especially agricultural products, are only slightly benefited, whereas the home interchange of goods in our own country is made much easier.

4. That the great economic advantages of the undertaking far outweigh the individual disadvantages of the same.

## CANAL TOLLS.

It may be concluded that the navigation tolls to be established would suffice to cover at least a 3½ per cent interest and payments on the capital, besides paying for the care and operation. Whether or not it would be possible to increase these tolls would depend upon business conditions at the opening of the canal. In the course of eight or ten years, the time which will elapse before the completion of the canal, these might be materially changed, and it stands to reason, therefore, that a fixed rate of toll can not at present be determined upon.

The foregoing estimates as to traffic and profits are based upon a canal toll, according to the different classes of merchandise, of 2, 1.50, and 1 pfennig the ton-kilometer for the Dortmund-Rhine Canal, and of 1, 0.75, and 0.50 pfennig the ton-kilometer for the Central Canal. These rates are really higher than those charged on other Prussian waterways. For instance, the navigation tolls, reduced to the ton-kilometer of the actual shipment, amount to about 0.32 and 0.16 pfennig on the canal from the Oder to the Spree; to about 0.48 and 0.24 on the canalized upper Oder, to about 0.60 and 0.30 pfennig (from October 1 of this year) on the canalized Main. The rate of 1.7 pfennigs and 0.85 on short waterways is an exceptional rate given under special circumstances.

That a high rate on the Dortmund-Rhine Canal, which is in reality a continuation of the Rhine—a waterway exempt from all tolls —is possible, as explained above, ought later to be proven just also. The Central Canal will probably be able to bear higher tolls than do the existing waterways, as it far surpasses them in capacity and extent, so that navigation is carried on under specially favorable conditions. Moreover, this canal has to compete merely with the railroads, not with other waterways which are free of tolls, as does, for instance, the Dortmund-Ems Canal, on which the rate of tariff depends chiefly upon the competition of the Rhine. It can not, of course, be foreseen how far these favorable circumstances may be altered by the development of traffic on seagoing vessels, which navigate the open ocean (as, for instance, in the coal trade directed

to the lower Weser), as there has been no experience hitherto on which to base calculations.

The way to proceed, therefore, will be first of all to introduce the above-mentioned rates, which, moreover, would probably be in accordance with the ideas of the parties interested, as in their calculations regarding their guaranties they used these same rates.

The government, moreover, will be induced to further home industries as far as practicable by means of toll regulations; it also intends, before the publishing of the tariff rates, to hear the reports of experts concerning the industries, agriculture, and commerce of the different participating districts other than the guarantors.

### THE GUARANTY DEMANDED OF THE PROVINCES.

It stands to reason that that part of the country which will receive the greatest benefit from the canal should assume, in advance, the cost of the undertaking, particularly as thereby a guaranty that the canal really possesses the supposed economic value will be gained. Whereas formerly when a canal was constructed the turning over of the territory, free of cost, or the determined value of the same, was demanded of the parties interested (as is at present the case with government railroads), a considerably greater participation in the cost was already contemplated in the bill of April 17, 1894, for the building of the Dortmund-Rhine Canal, by their assuming a part of the expense of the interest and liquidation of the capital and the cost of care and operation. When the measure was presented to the lower house of the Prussian Parliament (Abgeordnetenhause) this share of the risk in the undertaking demanded of the provinces was several times denounced as too small. In the present bill the government has shown itself of the same opinion. As far as the raising of the money is concerned, there is in it a greater cooperation of the various parties interested than has ever before been the case in a government undertaking. The construction of the Rhine-Elbe Canal is only to be undertaken if the interested provinces or other States guarantee to meet in full from their own funds, any deficiency in the yearly cost of care and operation (as fixed upon by the minister of public works, and not covered by the navigation tolls or such like receipts), as also in the yearly 3 per cent interest on one-third of the estimated capital of the main canal, and on one-half of the estimated capital of the branch canals, and for the liquidation of this share at one-half per cent per annum. The locally separated parts of the Rhine-Elbe Canal, namely, the Dortmund-Rhine Canal (from Laar to Herne) and the Central Canal (from Bevergern to the Elbe), are considered as two separate undertakings, as far as the guaranty is concerned, for the parties interested in the two are essentially different.

In consideration of the general public usefulness of the canal the rate of interest guaranteed is placed at 3 per cent, in spite of the present unfavorable condition of the money market for the issuing of a government loan. It seemed advisable, however, in the interest of the participating States, to extend the guaranty, at the same time, to a moderate liquidation of the capital, thereby limiting the time that the interest need be carried. The rate of the liquidation was fixed by the representatives of the States at one-half per cent on the estimated capital, together with the interest saved upon the gradually

decreasing capital. In consideration of the difficulties of the undertaking at first, it is intended to postpone the payments toward the liquidation of the debt until the sixteenth year after the completion of the canal. It follows, therefore, that each fiscal year from the date given the amount of one-half per cent on the capital appropriated, with the accruing interest, shall be credited, together with any possible surplus in the canal tolls over and above the expense of care and operation, interest, and ordinary payments on the capital. In this way the share of the capital on which the provinces are to guarantee interest and payments will be gradually lessened. The capital invested will be entirely paid off and the obligation of the provinces canceled in about sixty-six years, unless extra payments can be made from a surplus in the canal receipts.

The guaranty for the cost of care and operation, on the other hand, is, by its very nature, a continuous one, and it is recommended that this guaranty should be continued even after the capital is entirely paid off, so that the former participants may always remain interested in the undertaking and by so doing assure the levying of suitable tolls. The directions given in section 2 of the bill concerning the paying off of the capital aim to fix the amount of the obligation for the different provinces, though leaving untouched the subject of the Government's payments.

The loan for the building of the canal, upon which the present bill is based, will at first form a part of the common national debt, and will be paid off according to the law enacted March 8, 1897. Any postponement in its payment will not be permitted under any circumstances.

The form of participation contemplated assures to the participants the advantage of having to contribute only in case, and to the extent, that the works do not pay for themselves, and in any case, of not being obliged to pay until after they have already begun to enjoy the benefits of the canal. At the same time this arrangement leads to a very just division of the burden, inasmuch as by it those who make use of the canal each year will be made to contribute according to the degree of their interest, whereas by the other method of demanding the free gift of the ground, or its price, à fonds perdu, only those interested at the time were affected, and these only in part, as many would avoid this voluntary action.

Such guaranties can, by the nature of the thing, only be undertaken by public institutions (verbänder), therefore best of all by the provinces. In regard to raising the money needed to pay this guaranty the districts or parts of districts most benefited would first be called upon, and in these the communities most benefited; and here again the interested individuals would be taxed first, according to the degree of their interest. The provinces have the right from the laws of the country to lay such a division of the burden upon the districts without further legal proceedings. As there might be some doubt, however, as to the right to lay such a burden on the communities, and in these on the individual tax-payers, the subject has been specially referred to in section 6 of this bill.

The cost of the completion of the Dortmund-Ems Canal, on that portion which will fall in the line of the Rhine-Elbe Canal, and which will amount to 4,067,000 marks, is not to be divided among the provinces. It has to do here with the completion of an existing government canal, whose revenue, in consequence of the construction

of the Rhine-Elbe Canal, will be increased to a greater amount than needed for the interest and liquidation of the capital used for completing the works, as well as the cost of care and operation. It is understood, of course, that the tolls for the use of the Dortmund-Ems Canal, even those levied on the traffic brought by the Dortmund-Rhine Canal, and the Central Canal, will be applied exclusively to the cost of care and operation of the Dortmund-Ems Canal and to the interest and liquidation of the capital invested in the same.

The following table shows the share of both the Government and the provinces in the different parts of the undertaking, and the share of the guaranty falling to the different provinces.

| 1 | 3 | Cost of construction. | | | Cost of care, maintenance, and operation. | | |
|---|---|---|---|---|---|---|---|
| Description of canal. | Length. | 4 Total. | 5 Share of the Government. | 6 Share of provinces. | 7 Total. | 8 Share of Government. | 9 Share of provinces. |
| 1. Dortmund-Rhine Canal, Emscher Valley Canal (Laar-Herne) | *Km.* 39.5 | *Marks.* 45,298,000 | *Marks.* 30,198,670 | *Marks.* 15,099,330 | *Marks.* 509,200 | *Marks.* ..... | *Marks.* 509,200 |
| 2. Completion of Dortmund-Ems Canal (locks at Henrichenburg and second lock at Munster) | 1.3 | 4,067,000 | 4,067,000 | ..... | 36,600 | 36,600 | ..... |
| 3. Central Canal (Bevergern to Elbe) with 8 side canals | 413.6 | 191,668,700 | 121,057,220 | 70,611,480 | 1,347,300 | ..... | 1,347,300 |
| 4. Canalizing of the Weser: | | | | | | | |
| *a.* Bremen-Minden[a] | (149.3) | (42,628,000) | ..... | (42,628,000) | ..... | ..... | ..... |
| *b.* Minden-Rinteln | 43.4 | 14,622,000 | 9,748,000 | 4,874,000 | 193,200 | ..... | 193,200 |
| *c.* Rinteln-Hameln | 17.7 | 5,192,000 | 2,564,500 | 2,564,500 | 82,800 | ..... | 82,800 |
| Total | 515.5 | 260,784,700 | 167,683,390 | 93,149,310 | 2,169,100 | 36,600 | 2,132,500 |

| Description of canal. | Interest and payments on cost of construction=3½ per cent of columns 4, 5, and 6. | | | Combined yearly cost (columns 7 and 10). | | |
|---|---|---|---|---|---|---|
| | 10 Total. | 11 Share of Government. | 12 Share of provinces. | 13 (7+10) Total. | 14 (8+11) Government's share. | 15 (9+12) Share of provinces. |
| 1. Dortmund-Rhine Canal, Emscher Valley Canal (Laas-Herne) | *Marks.* 1,535,430 | *Marks.* 1,056,930 | *Marks.* 528,500 | *Marks.* 2,094,630 | *Marks.* 1,056,930 | *Marks.* { 100 p. ct. 1,037,700 |
| 2. Completion of Dortmund-Ems Canal (docks at Henrichenburg and second lock at Munster) | 142,300 | 142,300 | ..... | 178,900 | 178,900 | ..... |
| 3. Central Canal (Bevergern to Elbe) with 8 side canals | 6,708,400 | 4,237,000 | 2,471,400 | 8,055,700 | 4,237,000 | { 100 p. ct. 3,818,700 |
| 4. Canalizing of the Weser: | | | | | | |
| *a.* Bremen-Minden[a] | ..... | ..... | ..... | ..... | ..... | ..... |
| *b.* Minden-Rinteln | 511,770 | 341,180 | 170,590 | 704,970 | 341,180 | 363,790 |
| *c.* Rinteln-Hameln | 179,520 | 89,760 | 89,760 | 262,320 | 89,760 | 172,560 |
| Total | 9,127,420 | 5,867,170 | 3,260,250 | 11,296,520 | 5,903,770 | 5,392,750 |

[a] Will be paid for by Bremen.

| Description of canal. | Yearly share of guaranty to each province. | | | | | | |
|---|---|---|---|---|---|---|---|
| | 16 Rhineland. | 17 Westphalia. | 18 Hanover. | 19 Hesse-Nassau. | 20 Saxony. | 21 Schaumburg-Lippe. | 22 Brunschweig. |
| | *Marks.* | *Marks.* | *Marks.* | *Marks.* | *Marks.* | *Marks.* | *Marks.* |
| 1. Dortmund-Rhine Canal, Emscher Valley Canal (Laar-Herne) | 54 p. ct. 560,400 | 46 p. ct. 477,300 | | | | | |
| 2. Completion of Dortmund-Ems Canal (docks at Heurichenburg and second lock at Münster) | | | | | | | |
| 3. Central Canal (Bevergern to Elbe) with 8 side canals | | 17 p. ct. 649,179 | 50 p. ct. 1,909,350 | 4 p. ct. 152,748 | 18 p. ct. 687,366 | 6 p. ct. 229,122 | 5 p. ct. 190,935 |
| 4. Canalizing of the Weser: | | | | | | | |
| *a.* Bremen-Minden [a] | | | | | | | |
| *b.* Minden-Rinteln | | 61,845 | 181,895 | 14,552 | 65,482 | 21,827 | 18,189 |
| *c.* Rinteln-Hameln | | 29,355 | 86,280 | 6,902 | 31,061 | 10,354 | 8,628 |
| Total | 560,400 | 1,217,659 | 2,177,525 | 174,202 | 783,909 | 261,303 | 217,752 |
| | 5,392,750 marks. | | | | | | |

[a] Will be paid for by Bremen.

According to this table it will be seen that, for the Dortmund-Rhine Canal, the parties interested will bear the expense of the yearly care and operation to the amount of 509,200 marks and 3½ per cent interest and payments on one-third of the estimated capital, making a total of 1,037,700 marks yearly. The Government's share for 3½ per cent interest and liquidation of two-thirds of the invested capital will be 1,056,930 marks.

For the Central Canal, including the canalizing of the Weser from Hameln to Minden, the provinces must undertake the cost of care and operation to the amount of 1,623,300 marks, besides the interest and liquidation of one-third (with the branch canals possibly one-half) of the capital invested to the amount of 2,731,750 marks, making a total of 4,355,050 marks. The Government's share of the interest and liquidation being 4,667,940 marks. The total amount which the provinces are called upon to guarantee for the Dortmund-Rhine Canal and the Central Canal, including the canalizing of the Weser from Hameln to Minden, is 5,392,750 marks yearly; while the Government assumes 5,724,870 marks yearly, or, including the completion of the Dortmund-Ems Canal a yearly total of 5,903,770 marks, in so far as it is not covered by the canal receipts.

The share of the provinces, therefore, in the cost of the undertaking is but slightly less than that of the Government, from which it must be considered whether, in the first place, the cost of the care and operation will be provided for by the canals tolls; and whether, at the present market value of 3 per cent government bonds, the State can borrow the capital for the construction of the canal at 3 per cent, but rather at about 3⅓ per cent; the final estimate for the interest to be paid on the capital, moreover, has not yet been made. The appropriation, therefore, should be reckoned somewhat higher than it appears here; and the Government will also suffer some loss from the 3 per cent interest guaranteed by the provinces. Finally, should the amount of capital required for the construction of the canal exceed the amount appropriated (which, however, is considered quite sufficient) the share of

the provinces would not be increased; neither would it be lessened should the cost of construction be less than estimated. The amount guaranteed for the care and operation is also all sufficient; as far as can be foreseen an increase in the same could only come about if in the future the extent of the traffic should be greater even than expected, in which case, however, the increased cost would doubtless be covered by the increase in the canal revenue.

As the treasuries of the provinces and communities, however, must have a fixed sum on which to reckon—as otherwise the burden which they are to assume would be too heavy—any other way of determining the extent of the guarantee than that used in the bill seems impossible.

The directions given in section 4 are based on the supposition that the Rhine-Elbe Canal is to be treated—without harm to its economic significance and value—as a financial undertaking of great importance, and one which will be able to pay for and maintain itself in full. In order to carry out these directions the necessary accounts concerning the cost of the undertaking will be kept according to commercial rules, so that at any moment the standing of any one account could be seen.

The account of the canal receipts and the carrying out of the obligation guarantied will be kept as follows:

Since the Dortmund-Rhine Canal and the Central Canal are considered as two independent waterways in regard to the guaranty and the levying of tolls, the amount of money which will come from the navigation tolls for the use of both canals, no matter on which they are collected, will be determined by means of a settlement for each fiscal year between the participating sections. The amount determined upon, together with any other receipts of the canal, will first of all be applied to defraying the expenses arising from the care and operation of this section of the canal, as fixed each year by the minister under whose department it will be placed. To these expenses will belong all expenditures, personal salaries, etc., occasioned by the management, including the cost of the technical care of the canal, and also the providing of all machinery, implements, etc., and the renewing of any injured portion of the works.

Should the receipts of the canal in any one year not suffice for the expense arising from the care and operation, the deficit is to be met by the guaranteeing provinces, in so far as the actual expense of the care and operation does not exceed the amount laid down in the bill, namely, 509,200 marks for the Dortmund-Rhine Canal and 1,623,300 marks for the Central Canal, including the canalizing of the Weser. Any further deficit not covered by the receipts would be charged to the state treasury. Any surplus in the canal's revenue in one fiscal year which might remain over and above the cost of care and operation would be applied, in the same proportion, to the interest on the capital really given out by the State; and in the sixteenth year, at the earliest, after the canal is in operation, to the liquidation of the same at one-half per cent per annum and to the interest saved by the continual decrease in the capital. Should the receipts be inadequate the deficit is to be met by the participating States in proportion to their share in the cost; that is, according to the proportion of this share to the whole amount appropriated. The share of the different provinces in the cost of construction is fixed in the bill, but the Government's share can not be determined until after the final settlement

of accounts, as any overstepping of the amount will be charged to the State alone, and, on the other hand, any possible saving will be placed to its credit.

Should the receipts on any one canal in any one year exceed the expenditure for care and operation, as well as that for interest and payments on capital, the surplus is to be applied to further extra payments on the same, and after its complete liquidation to the paying back of any additional funds contributed by the Government and the provinces in former years, according to the proportion of these contributions, and finally after they are paid back to the restitution of the interest on the building money paid out by the State, and last of all for the vouching of a 3 per cent interest on the interest on the capital, which according to the nature of the appropriation will be carried, as well as on the additional contribution of the State and provinces according to the proportion of the interest due.

It is of course understood that upon any extension of the canal works—for instance, the building of new locks—the navigation tolls must first be used to cover the increased cost of care and operation, as also the interest and ordinary payments on the newly appropriated capital, before a surplus would be formed for extra payments or the other objects aforementioned.

The amount to be paid each year by the provinces to the state treasury, or by the latter to the former, will be fixed, once for all, by the minister under whose department the bill will be placed and the minister of finance, after a hearing of the representatives of the provinces, therefore to the exclusion of all redress by law. Redress before the law is not excluded because the State is a party to the transaction. Such an intention would be contrary to section 4 of the introductory law in the Civilprozessordnung of the 30th of January, 1877. Recourse to law is excluded rather for the reason that any such disputations with individual States would limit the business results and influences of the canal and the freedom of action and independence of the administration in a way not to be tolerated, and would be incompatible with an effective management.

The cooperation of the provinces and communities who have a share in the guaranty will be assured, as well as a voice in regard to the questions concerning the building and management of the canal and the fixing of the tariff rates. It is recommended that a standing committee be named for this purpose, at least during the time of the building of the canal, in which all the provinces concerned will be represented. It need not be understood from section 5 that the representatives must be appointed by law; it will be sufficient if the standing committee appointed by the Government and the provinces examine the calculations regarding the amounts to be paid, on the basis of which the regulations through the Government will follow.

Moreover, the details of this matter will have to be settled on the part of the Government after the agreements with the different communities, etc., in regard to the undertaking of the guaranty have been concluded.

As the participation in the great undertaking by the various provinces is the best criterion of the economic value of the same, the Government has thought it best not to use any compulsion in regard to their assuming their share of this guaranty, but rather to leave the negotiations concerning the same to a committee of the interested

parties, to be appointed upon the proposition of the Government. The state of the negotiations are at present as follows:

The guaranty demanded for the Dortmund-Rhine Canal may be looked upon as assured. The provincial committee (provinzialausschuss) of the Rhine Province agreed, under date of August 9 of last year, to recommend to the provincial assembly (provinziallandtag), convened in February of this year, the undertaking, under the conditions laid down by the Government, of that part of the guaranty which will fall to this province according to the length of the canal in the same (the cost of care and operation to the amount of 276,800 marks, 3 per cent interest, and one-half per cent yearly liquidation on 54 per cent of the third of the total cost of construction of 45,298,000 marks). The motion, unanimously recommended by the *provinzialausschluss* (provincial committee) was carried in the *provinziallandtag* (provincial assembly) by a large majority.

The districts of Gelsenkirchen, Recklinghausen, and Bochum Land have each undertaken its share in the part of the guaranty falling to the province of Westphalia (Gelsenkirchen to the amount of 197,200 marks yearly, Recklinghausen to 166,000 marks, Bochum Land to 114,100 marks). The decision has already been approved by the present *bezirksausschuss* (district committee).

In regard to the Central Canal (Bevergern to the Elbe) the conditions are somewhat more difficult, as here the parties concerned are very numerous and their interests are very different. It has been determined on the part of the provinces interested that each district's share in the cost of the construction of the canal, which in general corresponds to the length of the canal in the same, shall be used as the measure for the division of the guaranty. Accordingly, therefore, 17 per cent would fall to the province of Westphalia, 50 per cent to Hanover, 4 per cent to Hessen Nassau, 6 per cent to the Principality of Schaumburg-Lippe, 5 per cent to the Duchy of Braunschweig, and, finally, 18 per cent to the province of Saxony. In Westphalia the *provinziallandtag* (provincial assembly) agreed on the 31st of January of this year to assume the guaranty demanded as their share.

In Hanover the *provinziallandtag* had already agreed in February of this year to the undertaking of the guaranty in the amount then stipulated. The provinzialausschuss is ready, therefore, to conclude an agreement with the Government upon the subject, but as the costs in the final statements are higher than those which were assumed by the provinziallandtag in its resolution, it has reserved to itself the privilege of laying the agreement concluded with the Government again before the provinziallandtag for approval. In Westphalia, as well as in Hanover, the terms fixed on by the provinces for the division of the guaranty among the interested cities, as against the provinces, are already consummated. It may therefore be assumed that Westphalia will undertake 17 per cent and Hanover 50 per cent of the guaranty demanded for the Central Canal, as first settled upon. The amount of the guaranty, at the highest, will be for Westphalia 740,359 marks, for Hanover 2,177,525 marks.

In Saxony the provinziallandtag has refused to undertake the obligation. It is expected, therefore, that of the 18 per cent of the whole which will fall to the province of Saxony, Magdeburg will assume the largest part, namely 16.1 per cent. The negotiations of

this city concerning the cooperation of other parties in assuming the guaranty have not yet been concluded.

As to the share in the cost of the canal which will fall to Hessen-Nassau, Schaumburg-Lippe, and Braunschweig, amounting altogether to 15 per cent, the local authorities are not yet ready to assume the guaranty. The committee intrusted with the procuring of the guaranty, therefore, has requested Berlin, the principal city of the Empire and the residence of the Emperor, and the free city of Bremen, both of which have a great interest in the building of the Central Canal, to bear 7.5 per cent of the guaranty, besides which Berlin shall assume the 1.9 per cent still unprovided for of the share of the guaranty falling to Saxony. Probably the 9.4 per cent which would in that case fall to Berlin would be assumed by this city and a few other communities, Charlottenburg, Potsdam, Spandau, and Brandenburg (the latter altogether 2.9 per cent). The final resolutions are still pending.

The remaining 7.5 per cent of the guaranty which Bremen has been requested to assume will probably be undertaken by this city, if, as is expected, the canalized portion of the Weser from Bremen to Minden be continued to the Central Canal.

According to the foregoing the participation of the different provinces in the undertaking seems not yet assured, but it is necessary, in a short time after the presenting of this bill, to know with certainty whether the undertaking will be carried out, as otherwise the basis of the estimation as to cost, especially in the industrial district, might undergo important changes; therefore a clause is placed in the bill stating that the obligations demanded must be assumed in binding form before the 1st of July, 1900. This limit is decided upon as within a year after the expected passing of this bill, the difficulties still standing against the providing of the guaranties would certainly have been removed if these guaranties were to be attained at all. If not, then on July 1, 1900, the bill will become invalid, and for any further carrying out of the project first a revision of the estimations as to the cost, and, finally, renewed negotiations in regard to the participation of the provinces in the cost, etc., must be entered upon.

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# THE ROYAL COMMISSION ON CANALS AND WATERWAYS.

## SUMMARY OF THE REPORT OF THE ROYAL COMMISSION ON CANALS AND WATERWAYS OF GREAT BRITAIN, BY MR. WOODBURY PULSIFER, SECRETARY COMMITTEE ON COMMERCE, UNITED STATES SENATE.

### THE ROYAL COMMISSION ON CANALS AND WATERWAYS.

This commission was appointed March 5, 1906.

MEMBERS.

Right Hon. Lord Shuttleworth, chairman.
Right Hon. Lord Kenyon, K. C. V. O.
Right Hon. Lord Brassey, G. C. B.
Right Hon. Lord Farrer.
Right Hon. Sir John Edward Dorington, Bart.
Right Hon. Sir John Tomlinson Brunner, Bart., M. P.
Sir John Wilson, Bart.
Sir Francis John Stephen Hopwood, K. C. B., K. C. M. G.
William John Crossley, esq., M. P.
Russell Rea, esq., M. P.
James Farquharson Remnant, esq., M. P.
Philip Snowden, esq., M. P.
Henry Vivian, esq., M. P.
Laurence Ambrose Waldron, esq., M. P.
Robert Cope Hardy Davidson, esq.
John Purser Griffith, esq.
Andrew John Herbertson, esq.
James Charles Inglis, esq.
Henry Fison Killick, esq.
Matthew Joseph Minch, esq.
W. B. Duffield, esq., secretary.
Mr. R. B. Dunwoody, Assoc. M. Inst. C. E., assistant secretary.

The commission was commanded to inquire into the canals and inland navigation of the United Kingdom and to report on—

(1) Their present condition and financial position.

(2) The causes which have operated to prevent the carrying out of improvements by private enterprise, and whether such causes are removable by legislation.

(3) Facilities, improvements, and extensions desirable in order to complete a system of thorough communication by water between centers of commercial, industrial, or agricultural importance and between such centers and the sea.

(4) The prospect of benefit to the trade of the country compatible with a reasonable return on the probable cost.

(5) The expediency of canals being made or acquired by public bodies or trusts and the methods by which funds for the purpose could be obtained and secured; and what should be the system of control and management of such bodies or trusts.

The report is in four folio volumes.

Volume 1, part 1, contains only the first report, on a single page, as follows:

"May it please Your Majesty,

"We, the undersigned commissioners, appointed to inquire into the canals and inland navigations of the United Kingdom, desire humbly to submit to Your Majesty the following report of our proceedings:

"Twenty-two meetings have been held and 54 witnesses have been examined, notes of whose evidence, with other information relating thereto, are appended.

"We propose, when we resume our meetings, to take further evidence, and the first question which will then engage our attention will be the canals and inland navigations in Ireland. Later we propose to hear further witnesses from England and Wales and Scotland.

"Meanwhile we think that it is desirable, availing ourselves of Your Majesty's gracious permission to report our proceedings from time to time, to submit at the earliest possible date the evidence already taken.

"All which we humbly submit for Your Majesty's gracious consideration."

This report was submitted July 31, 1906.

# VOLUME I, PART II.

## EVIDENCE AND APPENDICES.

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### Suggested Heads of Evidence Supplied by the Commission for Witnesses Who Represent

#### (a) municipal bodies or local authorities.

Witnesses are requested, in preparing their evidence, to bear in mind that the commissioners desire to receive facts and opinions on the following points:

1. What defects or other obstacles (e. g., insufficient gauge and variations of gauge, difficulty of obtaining through tolls or rates, etc.) now stand in the way of your benefiting to the full from waterways already existing? What improvements would enable your population to use waterways to a larger extent for their own business?

2. Is it desirable to construct new or enlarge existing waterways in your neighborhood? With which seaport do you consider it most important that such waterways should connect your district? What is the prospect either of a direct or of an indirect return for the expenditure?

3. Would you favor any local contribution toward the attainment of these objects, either in money, or by the construction of local works, such as an inland harbor?

4. For your local trades, which is preferable: The carriage of goods by the body controlling the waterway, or by other carriers?

5. Are you in favor of an amalgamation of the canal companies or other authorities on the through route which would connect your district with the sea? If so—

(*a*) What method would you suggest for bringing this about?

(*b*) How would you propose that the money for improving the waterways constituting that through route should be obtained?

(*c*) Also how should such a through route be administered in the future, e. g., by a board formed from the present canal companies, etc., or by representative local control, or by central or state control?

(*d*) Which are the canal companies in your district which, in your opinion, should be amalgamated either for the purposes of a main route or as feeders to that route?

6. What effect, in your opinion, would the establishment of an improved national canal system, either under amalgamated, local, or state control, have on the charges for carriage in local trades and on the general development of those trades and the prosperity of your district?

7. Supposing that a new system of canal control were instituted, either for main routes or generally, what system of control would you recommend (e. g., amalgamated boards, local representative bodies, or state control)?

8. If local control were established for a district comprising that under your local authority—

(*a*) Can you suggest a scheme for such control?

(*b*) Can you give an assurance that your local authority would be ready to bear its part, administrative and financial?

9. If state control were established, what part, if any, would the local authority which you represent be ready to take within its district in connection with such control in addition to the local contribution suggested under head 3?

## Suggested Heads of Evidence Supplied by the Commission for Witnesses Who Are

### (B) traders or agriculturists.

Witnesses are requested in preparing their evidence to bear in mind that the commissioners desire to receive facts and opinions on the following points:

1*a*. What defects or other obstacles (e. g., insufficient gauge and variations of gauge, difficulty of obtaining through tolls or rates, etc.) now stand in the way of your benefiting to the full from waterways already existing? What improvements would enable you to use waterways to a larger extent for your own business?

1*b*. Is it desirable to construct new or enlarge existing waterways in your neighborhood? With which seaport and with which inland towns and districts do you consider it most important that such waterways should connect your district? What is the prospect either of a direct or indirect return for the expenditure?

1*c*. Would you favor any local contribution toward the attainment of these objects, either in money or by the construction of local works, such as an inland harbor?

2*a*. A criticism, based on your own knowledge, as to the comparative cost of carriage by water, rail, or road, for short or long distances, and for different classes of goods.

2*b*. For your trade, which is preferable, the carriage of goods by the body controlling the waterway or by other carriers?

3. What effect would the establishment of an improved national canal system, either under state or local control, have on the charges for carriage in your own trade and on the general development of that trade?

4. Supposing that a new system of canal control were instituted, either for main routes or generally—would you recommend that it should be under national control or under local trusts?

### SUPPLEMENTARY HEADS FOR WITNESSES WHO ARE AGRICULTURISTS.

1. Do landowners, farmers, etc., in your district make use, and to what extent (give figures as far as possible), of canals and waterways: (*a*) For sending off produce, etc., or (*b*) for receiving feeding stuffs,

manures, tiles, building materials, etc., needed on the farms? State comparative use made of road, rail, and water.

2. What is the nature of the principal agricultural products in your district? Are there any that could be conveyed by water without risk of deterioration? And in quantities large enough to fill a canal boat?

3. Is there such a demand among the farmers in your neighborhood for the improvement of its waterways or for the construction of new ones as would insure a widespread use of them by the agricultural community?

4. Would the agriculturists in your neighborhood be able to employ the waterways to any appreciable extent without instituting some system of cooperation?

5. Are there any existing means of collecting agricultural produce and delivering it to any stations on your waterways? Or is there any good reason to believe that such a system would be widely adopted (if necessary) supposing that better waterways existed?

8. In what way, if any, do you consider that agricultural development is hampered in your neighborhood by the existing condition of your waterways?

## Digest of Evidence Taken by the Royal Commission on Canals and Waterways, 1906.

Col. Sir Herbert Jekyll, K. C. M. G., R. E. I have been assistant secretary of the railway department of the board of trade since 1900. That office is the one which deals with canal matters affecting the department.

### HISTORY OF CANALS IN GREAT BRITAIN.

The first canal made in this country is supposed to be the Fossdyke, now owned by the Great Northern and Great Eastern Railway companies jointly, and connecting Lincoln with the Trent. It is attributed to the Romans, and is undoubtedly of great antiquity. Another canal was made near Exeter, under authority of an act of Parliament passed in 1539. It is about 3 miles in length, and contains the first lock made in this country.

The first work of real magnitude was the Bridgewater Canal. The portion from the Duke of Bridgewater's collieries at Worsley to Manchester was authorized in 1759, was opened in 1761. An extension of this canal from Manchester to the Mersey at Runcorn immediately followed. The great success of the Bridgewater Canal caused the promotion of many canal schemes. The Trent and Mersey and the Staffordshire and Worcestershire canals, the Birmingtam and Coventry canals, and Oxford Canal followed in quick succession, with a further development of the Aire and Calder in 1774. The Grand Junction Canal, connecting London with the Midland canals, was authorized in 1793, and the rest of the canal system was built up in the next forty years.

Up to about 1830, when railways were started, the canals prospered very much; but the success of the early railways seems to have alarmed the owners of the canals, and a number of these properties which had been earning large revenues passed in the years 1845, 1846, 1847 into the hands of railway companies, while the earnings

on the canals remaining in independent hands were sensibly affected.

In 1870 there was a return presented to Parliament showing the tonnage carried on and the net revenue of canals in the years 1828 and 1838 (the high-water mark of canal prosperity), in 1848 and 1858; and a table has been prepared showing the tonnage and revenue of certain scheduled canals in these years and in 1888 and 1898, which appear in statement No. 1 in the appendix to my evidence. One remarkable feature of this table is that although the tonnage carried rather increased than diminished between 1838 and 1848, the receipts fell off enormously, pointing to the conclusion that railway competition had brought about a large reduction in canal companies' charges. It is also noteworthy that on such canals as the Oxford, Staffordshire and Worcestershire, and the Warwick and Birmingham the decrease in receipts has continued out of all proportion to the decrease, if any, in the tonnage carried. There are exceptional cases in which the tonnage has actually increased. No new canal has been constructed since 1898 excepting a small junction 5½ miles long.

Statement No. 2 in the appendix consists of lists of independent and railway-owned canals which were doing business in 1898, the last year for which we have returns.

The case of the Birmingham Canal, which appears in the list of independent canals, is peculiar. We do not class it as railway-owned, although it is to a considerable extent controlled by the London and Northwestern Railway Company. That company in 1846 guaranteed a dividend of 4 per cent on the canal company's capital of nearly £2,500,000. The canal company may not, however, without the consent of the railway company expend more than £500 on any new work, apart from repair and maintenance, or, without such consent, alter any tolls or charges. We have no knowledge how the system works, or whether the London and Northwestern do obstruct improvements in the canal or reduction of tolls, but it is significant that the canal carried 3,333,000 tons in 1838 and 8,620,000 tons in 1898, being more than one-fifth of the entire tonnage carried on canals in the Kingdom. Very little of that is through traffic. Seven million one hundred and eighty thousand tons is local traffic. The revenue in 1838 was £114,005 and in 1898 £208,036. That is gross revenue. The tonnage had increased out of all proportion to the revenue.

### PARLIAMENTARY INQUIRIES.

A select committee sat in 1846 on railway amalgamation, and made a special report on amalgamations of canals and railways. Their chief objection to such an arrangement seems to have been based on the great effect that railway competition had had on canal charges, and they mentioned that in some instances such charges had, in consequence of competition, been reduced to one-seventh of their former amount. The committee came to the general conclusion that it would not be politic altogether to refuse the sanction of Parliament to amalgamations, but that a searching inquiry should be made into each case, and the amalgamation should be sanctioned only when it was clearly proved to be without prejudice to the public. Notwithstanding this report, during the very same session Parliament allowed 17

canals, of a total length of 774 miles, to come wholly or partly under railway control by amalgamation, lease, purchase, or guaranty.

In 1872 a joint committee of both Houses sat on railway amalgamation. The committee found that railway companies had great advantage in such competition, although water has some advantage in the carriage of coarse or heavy articles, such as dung and lime, and also in the carriage of breakable articles, such as pottery. They also found that when terminal facilities for loading and unloading were great, canals could compete for short distances, up to, say, 60 miles; but that canals could not generally compete where the distances were great, or in the carriage of the more valuable goods, whilst the development of railway branches and stations had stopped many of the sources from which canal traffic had formerly been drawn. The committee gave instances in which railways had defeated canal competition by the purchase of links in a through system of navigation, and the discouragement of through traffic, and they refer to accusations brought against the railway companies of neglecting to repair their own canals, and thus suppressing the traffic. They point out that Parliament in many cases had endeavored to annex conditions to the amalgamations of railways and canals, compelling railway companies to maintain their canals in an efficient condition and keep them free and open for traffic, but that these conditions had not been effective, since such obligations can be more easily evaded than enforced, and, in short, that it is difficult to make a company maintain an effectual competition with itself. They further point out that Parliament felt it difficult to refuse to sanction amalgamation of railways and canals when canal shareholders under stress of railway competition came to Parliament alleging that the only way to save their property was to let a railway company buy it. Then to this report the committee attached six recommendations relating to canals, of which the first four are rather for the guidance of Parliament in dealing with future proposals for amalgamation of railways and canals, or of one canal with another, than for legislation.

Those recommendations were:

Competition by river and canal exists to a partial and limited extent only, and many important links of canal navigation are in the hands of railway companies, whose interest often is to depreciate them. It is important that an effort should be made to maintain the competition which now exists; and it is still more important, whether competition is maintained or not, that the capacities of inland navigation should be fully utilized and developed. The following recommendations have this object in view:

1. No inland navigation now in the hands of a public trust should be transferred to or placed under the control of a railway company.

2. The utmost facilities should be given for the amalgamation of adjoining canals with one another, or with adjoining inland navigations; and if the trustees of an inland navigation or a canal company apply to Parliament for power to purchase compulsorily a canal from a railway company, such purchase should be favorably regarded by Parliament.

3. No canal should be transferred to or placed directly or indirectly under the control of any railway company, nor should any temporary lease of any canal to a railway company be renewed until it has been conclusively ascertained that the canals can not be amalgamated with or worked by adjacent canals, or by a trust owning adjacent inland navigation.

4. Whenever a railway company applying to Parliament for amalgamation has any canal communication in the district under its ownership or control, the propriety of continuing or modifying such ownership or control should be a subject of investigation by the joint committee referred to below.

5. The principles of railway and canal traffic act should be strictly carried into effect by requiring every company owning or controlling a canal to maintain it in a state of thorough efficiency; to give every facility for through traffic; and to remove every obstacle, whether in the shape of bar tolls or otherwise, which are imposed for the purpose of impeding through traffic; and these obligations should be enforced by proceedings before the commissioners mentioned below.

6. The owners of any canal or inland navigation should have power to make a through toll or rate from or to any place on its own canal, to or from any place on any other canal, or on any railway forming a through route; the toll or rate to be divided between the owners of different parts of the route, as a general rule, according to mileage, but with a provision that if any objection be made to the proposed toll or rate or division as unfair, and no agreement can be come to, the commissioners mentioned below shall, upon application of any of the parties interested, decide the matters in dispute.

The regulation of railways act, 1873, gave effect to these recommendations to some extent. The railway commission, for which the railway and canal commission was substituted in 1888, was appointed with powers to decide disputes as to through rates or tolls, and provision was made for the maintenance by railway companies owning canals of such canals and for the supply of water to them. That was section 17. Section 16 enacted that:

No railway company or canal company unless expressly authorized thereto by any act passed before the passing of this act, shall, without the sanction of the commissioners, to be signified in such manner as they may by general order or otherwise direct, enter into any agreement whereby any control over or right to interfere in or concerning the traffic carried, or rates or tolls levied on any part of a canal is given to the railway company, or any persons managing or connected with the management of any railway, and any such agreement made after the commencement of this act without such sanction shall be void.

That section goes on to instruct the commissioners not to sanction any such agreement which is prejudicial to the interests of the public in their opinion.

There is a difficulty in the way of a through rate from a point on a canal to a point on a railway, in that canal companies are often not themselves carriers, whilst railway companies are always carriers, and the services of the two parties to such a through route are not the same.

Canals, as a rule, charge tolls; the public has the use of the canal, paying the company tolls for the use of it, but they do not as a rule carry themselves.

There was a further select committee of the House of Commons, which sat in 1881 and 1882 on railway and canal charges and on the working of the railway commission. This committee heard some evidence with regard to railway-owned canals, and stated in their report that there was some foundation for complaints that had been made that railway companies having acquired possession or control of a canal had ceased to work it, or let it fall into disrepair, or charged excessive tolls, and thus diverted traffic to the railways.

One of their recommendations was, "That Parliament do not sanction any further control, direct or indirect, of canal navigation by a railway company," and another, "That the question of canals in Ireland being under different conditions to that of canals in England, and large districts in Ireland having no other means of communication, powers be given to local authorities or public trusts to acquire, extend, and maintain such canals in that country as may be deemed for the public benefit of the districts affected."

POWERS OF THE BOARD OF TRADE.

There are no such general provisions laid down by statute as to the construction of canals as there are with regard to railways, or as to the inspection thereof by the board of trade prior to opening, as in the case of a passenger railway, and, indeed, previous to the passing of the railway and canal traffic act in 1888, the board of trade, although no doubt exercising some indefinite authority over canal companies, had no real control. Powers were given to the board of trade in private canal acts, sometimes large powers, but they were not as a rule exercised. The provisions of the railway and canal traffic act of 1854 as to facilities for traffic and undue preference and of the regulation of railways act, 1873, as to the keeping of rate books, etc., applied as much to canal companies as to railway companies, and the railway commission established by the latter act had jurisdiction. The railway and canal traffic act of 1888 made important changes. Part 1 of this act substituted the present railway and canal commission for the railway commissioners. Part 2, dealing with traffic, applied equally to canals as to railways. Under section 24, revised schedules of maximum tolls, rates, and charges had to be submitted to and settled by the board of trade. Under this provision schedules of maximum tolls, rates, and charges were framed for 149 canals and subsequently confirmed by 15 acts passed in 1893–4. Part 3 of this act applies exclusively to canals. The most important provisions are as follows: Section 39 empowers the board of trade to call for returns from canal companies showing the capacity of the canal for traffic, and the capital, revenue, expenditure, etc. Section 41 empowers the board to make inspections of canals of which the works are said to be dangerous or a hindrance to traffic. Section 42 prohibits under heavy penalties the application of railway companies' funds for the acquisition of an interest in a canal without express statute authority. Section 45 deals with unnecessary or derelict canals, and provides that the board of trade may by warrant authorize the abandonment of such canals by the existing proprietors, who may by order be released from liability to maintain the same.

The proprietors of the Trent Navigation propose to make extensive works for the improvement of that river, and are applying to Parliament for the necessary powers.

The canal returns for 1898 show that there were then in operation in this country 3,907 miles of canals, of which 1,139 were the property of or controlled by railway companies. The corresponding figures for 1888 were 3,813 and 1,205. The increase in the total was due partly to the opening of the Manchester Ship Canal, 35½ miles in length, and partly to some companies having made returns for 1898 and not for 1888. The decrease in the railway owned canals was due to between 50 and 60 miles of canal having been transferred from the Great Central Railway to the Sheffield and South Yorks Navigation. The Birmingham canals are not included among the railway controlled canals, because the control of the North Western Railway is only a partial or contingent control.

The traffic carried in 1898 was 39,350,000 tons, as compared with 36,300,000 in 1888, an increase of about 8¼ per cent in ten years. In the same period the goods traffic on railways increased from 281,747,439 tons to 378,563,085 tons, an increase of 34¼ per cent. Looking

closer, however, into the returns of canal traffic, it appears that whereas the traffic on the independent canals increased by over 5,000,000 tons, that on the railway owned canals decreased by 2,000,000 tons, of which between 900,000 and 1,000,000 tons were due to the transfer of the Sheffield and South Yorkshire canals to the category of independent canals. This increase on the independent canals was also largely due to the traffic on the Manchester Ship Canal. But, allowing for this, it may perhaps be held that in 1898 the more important independent canals were holding their own, whilst the railway owned canals were losing ground.

In 1898, out of 32,538,691 tons carried on canals, 2,181,270 tons were conveyed by canal companies, and 30,367,421 tons were conveyed by traders. So the canal companies are direct carriers only to a very small extent. I think there is a tendency on the part of canals to become carriers. There was an application recently from the Regents Canal, who asked to have rates sanctioned as well as tolls.

## IRISH CANALS.

Mr. George A. Stevenson, M. V. O. I represent the Irish board of works; am one of the three commissioners of public works in Ireland.

While in England practically all canals were initiated by private parties, in Ireland, on the contrary, the State has from the beginning taken the greatest interest in canals and has given the greatest encouragement, both in the way of administration and in the way of grants. As early as 1703 inland navigation formed the subject of consideration in the Irish Parliament. The first statute was passed in 1715: "An act to encourage the draining and improving of bogs and unprofitable low grounds, and for easing and dispatching the inland carriage and conveyance of goods from one part to another within this Kingdom." Apparently the only navigation work carried out under this act was on the river Maigue, connecting the town of Adare and the Shannon.

Up to 1800, £857,382 had been issued in aid of navigation works, of which £351,946 came from "tillage duties" and £505,436 from parliamentary grants and grants by royal letters and local duties. In 1800 an act was passed enabling the lord lieutenant to appoint five persons to be directors of all works relating to inland navigation, with full power to order, direct, regulate, and appoint all matters relating to inland navigation. A grant of half a million was made for inland navigation and for the improvement of the port of Dublin. Other sums of money were expended by these directors, and all the navigations that were unfinished in 1800 were brought to completion except the Shannon. In 1829 complaint arose. Great sums of public money had from time to time been expended on inland navigation without corresponding advantage to the public, and on the establishment of the board of works in 1831 all the property vested in the directors of inland navigation and all the powers possessed by them were transferred to the new board. Since then the following navigations have been constructed: the River Suir from the town of Carrick-on-Suir down to the neighborhood of Waterford; the Ballinamore and Ballyconnell Navigation; the upper and lower Bann; the

Lough Corrib; the Ulster Canal; the upper and lower Loughs Erne; and the River Shannon Navigation was completed.

In 1882 the "Report of Lord Monck's Commission on Inland Navigation" stated that the estimated total cost of 708 miles of canal and river communication provided by the schemes, 16 in number, was £4,722,211. Of this amount there was charged on counties, practically advances of public money either in the way of loans or advances on works, and repaid by the counties, £385,364; from private sources, £2,296,349; and public money, free grants, £2,040,498. So that putting together what was charged to counties and the public money, more than half of the expense came from public sources.

None of the canal systems carried out since the transfer have been carried out under the powers transferred from the directors of inland navigations. They have either been done by private companies under special acts, such as the Suir and the Ulster, or, even when carried out by the board itself, they have been done under relevant public acts—for instance, the Corrib and other navigations. In the case of the Shannon the board control the whole navigation from tidal water at Limerick to Boyle and Lough Allen at the north end of the river; and for this purpose the board are legally a canal company, and as such come under general canal legislation, whether emanating from the home office or the board of trade. The former have to decide as to cranes, loading, fencing of quays, and the latter have to do with rates and facilities. The rates of navigation are fixed under the railway and canal traffic act of 1888, by provisional order, confirmed by an act. The board is not a carrying company like the Grand Canal Company; it does no carrying; its revenues are derived from rents of property and fisheries and the tolls paid by by-traders and are about sufficient to cover its expenses—the principal by-trader being the Grand Canal Company.

The Lagan Navigation Company pays a rent of £300 per annum to the exchequer, and has to submit its accounts for audit by the board of works before declaring a dividend. There are some arrears in its payments. The same company took over the Ulster Canal from the board under a private act.

The board of works, in connection with navigations constructed with reference to arterial drainage, namely, the Lough Corrib, the Bann, the Ballinamore and the Erne, have a general power, on the direction of the lord lieutenant, with the consent of the treasury, and on the complaint of persons interested, to call upon the trustees in whom these navigations are vested to carry out necessary works of maintenance, and in their default to do the work themselves and charge the cost on the district. That power has been exercised but very little.

The board of works have an indirect power over the Royal Canal, because it is really vested in a board of control nominated by the lord-lieutenant, but in practice the lord-lieutenant appoints as the board of control the members from time to time of the board of works. In 1846 authority was given for the sale of the canal to the Midland Great Western Railway Company, with a provision that "all the works connected with it shall be maintained, upheld, and preserved by the company for the purpose of navigation in as full, ample, and perfect a manner as by the act of 1818 is authorized and required, and the lord-lieutenant and the board of control shall

exercise the same powers over the railway company and canal as over the canal company and canal."

There are two points of view upon which the effect of the legislation has not been satisfactory; that is to say, the great cost of the canals, the long time they took in being built, their comparative failure even then, and the present condition of the canals as affected changes in more recent years. Apparently the causes of the comparative failure at the start of those canals was that there was no very clear idea as to how the results that were expected to arise from the navigation were to be brought about practically; the commissions were extremely cumbrous; there does not appear to have been an elaborate engineering inquiry by the Government or by the companies as to exactly what was to be done; and the result was that we have canals on which there are different sizes of locks, even on the same canal. For instance, if you take the Lagan Navigation, the Newry Navigation, and the Ulster Canal, the size of boat is different in each case that can work the canal, although the three canals connect together in Lough Neagh. The result has been incommensurate with the expenditure. There was great lavishness of expenditure. In later years the formation of navigation was treated as an adjunct to drainage. Most of the schemes were carried out before the railway era; the railways have taken away the great bulk of the traffic and the physical defects of the canals render competition by them difficult in nearly every case. The other causes have been the reduction in inland population, the change from tillage to cattle rearing, and the facilities for the importation of foodstuffs, which have been very adverse to navigations, which in nearly every case were intended to serve considerable rural populations exchanging locally the products of the soil.

The board of works takes a very active interest in certain canals, but not a general interest. The only canal navigation that we control is the Shannon Navigation. We have no representation on the boards of other navigations, although they have profited by the expenditure of public money. The baronies and local authorities have representation on the direction of only those waterways which have been made in connection with arterial drainage, and in that case the trustees are appointed locally, and the control of the navigations, such as they are, is vested in local trustees appointed by the counties. The board of works has no means of seeing that the best use is made of the navigations to which the State has contributed. Some of the Irish navigations are working and doing a considerable amount of work, but speaking generally the result has not been good. The board has not discussed whether the expenditure of money to improve the navigations would be a good thing for Ireland. So far as we have discussed the advisability of extending them, our opinion is that there is not much advantage to be got from it, whereas there might be advantage in rearranging works so as to enable different navigations to be worked as one — for instance, that one class of boats should be available on several navigations. A reduction of the number of controlling bodies would be desirable.

The evil is mainly economic; that is to say, if there was traffic and resulting revenue, improvements could be made, but at present, even if the Government had control and was represented on the boards of directors, there is not the money coming out of the canals which

would enable improvements to be made. The biggest canal in Ireland, the Grand Canal, only pays a dividend, I think, of 4 per cent on its ordinary stock, and 3 per cent on its preference stock. The other canals practically pay nothing. The Lagan Navigation at one time paid about 1½ per cent on a capital of £80,000, and in recent years it has not even paid that.

The Shannon Navigation pays its way so far as expenses are concerned. The principal trader on it is the Grand Canal Company, which runs from Dublin to Shannon; and that company pays a dividend. They simply run their boats on the navigation and pay toll. The Shannon Navigation is in very good condition physically. Certain sections of it might be considered as a model for Irish navigation. There are four sections of it. The section below Killahoe has 16 locks which are very much smaller than the locks on the section above, and on the northern section the size is even smaller.

On the Ulster Canal the minimum lock is 72 feet by 11 feet 10 inches in width and 3 feet 9 inches in depth. It was transferred to the board of works, who took it over under a special act of Parliament, because of large public loans and the canal having been a failure. In 1882 Lord Monck's commission recommended that if it could not be sold it should be drained and the land used for any purpose that seemed advisable. Then in 1888 the Lagan Company took it over. The western section is not worked. The company is losing money on it. The Lagan boats can not go down the Ulster Canal. The Newry boats are too wide to go on the Ulster.

In considering the practicability of improving these canals you have to consider railway competition alongside. Although the Ulster Canal is very little used, we know as a fact that it does keep down certain railway rates; so the amount of traffic on it is not a measure of its usefulness.

## THE THAMES AND SEVERN CANAL.

Right Hon. Sir JOHN E. DORINGTON, Bart. I am chairman of the Gloucester county council. I am a member of this commission. I propose to speak of the Thames and Severn Canal. This canal, about 30 miles in length, including the branch to Cirencester, became the property of the county of Gloucester in 1901 in consequence of provisional order made by the board of trade under the railway and canal traffic act, 1888, as a derelict canal.

The canal was originally opened in 1799, and King George III came to the opening of the tunnel which was at that time a very remarkable work; it was 2 miles long through the Cotswolds, and the cost is said to have been £245,000. The canal was quite successful until the opening of the Great Western Railway in 1841, and the tolls at that date amounted to £11,000 a year. It paid dividends on its ordinary stock until 1873. The canal engineer reported in 1883 that the cause of Thames barges no longer using the canal was not the fault of the canal, but of the condition into which the Thames had been allowed to fall, so that such vessels could no longer navigate the upper Thames. The fact was that as soon as railways came the Thames Conservancy lost their tolls and they could not maintain their river, with the consequence that the traffic on this canal fell and began to lose its revenue. The canal income became unequal to the

repairs. No Thames barge passed subsequent to 1855 because the Thames had become unnavigable, and in 1841 the Great Western Railway to the west was completed. In 1881 its income was £1,538 and its loss £389.

The secretary of the Great Western Railway wrote to the board of trade in 1886 that the Thames was so shallow that raffic in full boat loads could not pass. The attention of the conservancy was called to this and they have in the last few years spent £20,000 on weirs, locks, and dredging, and the river is now navigable except for the formation of newly deposited shoals which they are always prepared to deal with. The conservancy are doing their duty by the Thames now, but a test voyage about 1880 showed that a boat drawing only about 9 inches of water would not pass down the Thames—in fact, the Thames had become absolutely unnavigable; even in a rowboat there was difficulty. I do not think they would have restored the navigation of the Thames unless they had understood that the canal was going to be reopened by the public trust. That trust was unsuccessful for want of funds. The habit of traders to send their goods to London by the canal and the Thames has hardly been restored at present; two or three cargoes have passed to London. The public trust of 1895 had an estimate of £10,300 for repairs to the canal. It proved quite inadequate; they opened the canal in 1899, and in one month they found they had made a total failure. The county of Gloucester, the city of Gloucester, and the towns of Stroud and Cirencester were together responsible for £400 a year toward interest and extinction of debt which the public trust had been authorized to incur. The county being faced with the fact that this sum was going out for no consideration, and as it was thought no very large sum would be required to complete what the public trust had begun, the county council decided to complete the work. The canal was opened for through traffic in 1904. After being kept open some months we found there were serious defects below the summit which had not been sufficiently recognized. It was closed again and opened in 1905; kept open a few months and closed again, both on account of the shortness of water and because of defects. The expense of restoration has been £29,832, and that has been met by a loan of £13,000, and the remainder has been drawn from the rates. It was agreed that the county council would raise a halfpenny rate every year toward these expenses until the loan which they had raised was cleared off.

The traffic results have not been satisfactory, because the trading had entirely disappeared over the canal, and it was quite obvious it would take time to restore it. I am quite satisfied that if we can keep open the whole year, and not for a few months in the spring, the traders will gain confidence and there will be considerable traffic on that canal; I hope sufficient to pay very nearly all expenses. If the canal can reach such an amount of traffic as will leave only a moderate sum per year on the county rate for the maintenance of the canal, I think we ought to be satisfied. I think it was a great matter that we did not allow this water communication between the Thames and the Severn to disappear. I think the county council took the correct course. It was not looked upon as a commercial speculation at all. If it had been a satisfactory commercial speculation, private persons would have been ready to take it up. The public authorities took it

up because they thought it advisable in the public interest. We spend about £70,000 on our main roads in Gloucestershire, and have about a thousand miles to maintain; and this canal will rather drop into the same category.

This is the only case of a county council holding a canal up to the present. If we had the old revenue of 1881, which was £1,538, there would be practically no loss to the county.

## SCOTCH CANALS.

Hon. Edward Gully, C. B. I am secretary of the commissioners of the Caledonian Canal and also of the speaker. Under an act of Parliament the speaker is one of the commissioners of the Caledonian Canal.

The Caledonian Canal lies in the counties of Inverness and Argyll in Scotland, and consists of an inland navigation extending from the Eastern Sea at Inverness to the Western Sea at Corpach, near Fort William. Its entire length of waterway is 60 miles, of which 22 miles consist of the canal proper, or artificial construction. The canal proper connects a chain of three lochs. There are 28 locks, all of the same size, 160 by 38 feet, with 15 feet depth of water.

In 1803 there was an act granting to His Majesty £20,000 toward the expense of making this navigation. In 1822 the canal was opened for traffic. There have been additional acts explaining and amending the original and widening the powers given and establishing further checks upon the expenditure of public money. And there was an act in 1840, and another in 1848, for incorporating the commissioners of the Caledonian Canal, and for vesting the Crinan Canal in the said commissioners. The navigation accordingly belongs to and is held by and vested in the commissioners. The ex-officio commissioners are the speaker of the House of Commons, the chancellor of the exchequer, the first lord of the admiralty, and the lord advocate, and the member of Parliament for the time being of the county of Argyll; and the appointed commissioners are the Duke of Argyll, Lord Lovat, Mr. Baillie, of Dochfour, and Colonel Malcolm, of Poltalloch. The meetings are held at the House of Commons. The commissioners have sole charge of the management and maintenance both of the Caledonian and Crinan canals. The annual income and expediture is between £7,000 and £8,000, the revenue exceeding the expenditure by a few hundred each year. That has sometimes been allowed to accumulate. There is a balance now of about £7,000. The tolls, rates, and charges are regulated, like those of other canals, by the board of trade, under the railway and canal traffic act of 1888. The canal is in good order now. At times its upkeep has been an expense to Parliament. The last time we had to apply was about sixteen years ago, when we got a grant of £20,000 for renewing the lock gates.

The commissioners are not entitled to make a profit. By section 25 of their act of 1860 it is provided that all rates levied and all rents received and all moneys borrowed under authority of the act shall be expended on the canals and in providing additional accommodation for the traffic or in making docks, basins, or slips.

The Crinan Canal extends from Ardrishaig on Loch Gilp to Crinan on Loch Crinan, in the county of Argyll, a distance of 9 miles, with

a summit level of 64 feet, and is almost entirely an artificial construction. The distance from Ardrishaig to Crinan, round the Mull of Kintyre, is upward of 132 miles. From the Firth of Clyde a sheltered passage nearly 85 miles shorter than the exposed voyage around the Mull is secured by boats passing through the canal.

The canal was constructed in 1793 by a company of proprietors consisting of the then Duke of Argyll, the Marquis of Treeddale, the Marquis of Lorne, the Earl of Breadalbane, and a large number of gentlemen resident in that neighborhood.

The canal was opened for traffic in 1801. Statutory power was obtained at various times to increase the capital, and various loans were got from the Government, amounting to £74,400. In respect of these grants the canal was made over to the Government. The last of these grants was in 1816. The commissioners of the Caledonian Canal continued to have charge of the Crinan Canal after that date, because there was no one else to undertake the administration. It was for many years left in a sort of tacit manner by the Government in the hands of these commissioners, until in 1848 an act was passed for incorporating the commissioners of the Caledonian Canal and for vesting the Crinan Canal in the said commissioners. The company ceased to have any interest in the undertaking then; they had the power to pay up the debt within twenty years and take back the undertaking. That was not exercised, and the Crinan Canal since 1868 has belonged to the commissioners in all respects in the same way as the Caledonian Canal.

In the Crinan Canal are 15 locks and about 8 miles of artificial bank, 7 swing bridges, and 9 storage reservoirs for water supply. The locks are 96 feet by 24. The largest vessel that can be passed is approximately 80 feet long, with a beam of 20 feet and draft of 9½ feet.

Schemes have been put forward for the improvement of the present canal and for a new ship canal. The estimate for a ship canal was £500,000.

The Crinan Canal is in fair order. Considerable expense will be required soon for putting the sea locks in order. We should have to apply to Parliament for money for that. Other necessary repairs can be done out of funds we have. The revenue of the canal is about £6,000 a year and the expenditure slightly under. The receipts on the Crinan Canal have steadily improved, especially since the advent of the turbine steamer. Steamers for MacBrane's tours use the canal. The pleasure traffic is an important part of the traffic on both canals. MacBrane is one of our chief customers. There is a very large transfer of fishing boats from one side of Scotland to the other through the Caledonian Canal at regular seasons.

Mr. ROBERT JACKSON. I am assessor of railways and canals in Scotland. My duties in relation to canals consist in fixing the annual valuation for the purposes of local taxation. Our revenues are derived from tolls and wharfage dues, and in addition there are steam towages on the Caledonian Canal.

There are four public canals in Scotland: The Caledonian and Crinan canals, concerning which Mr. Gully has testified; the Forth and Clyde Navigation, now owned by the Caledonian Railway Company; and the Union Canal, owned by the North British Railway Company.

The Forth and Clyde Navigation consists, first, of the Forth and Clyde Canal connecting the firths of Forth and Clyde. That was opened in 1790 from sea to sea. The main canal, 35 miles in length, starts from the mouth of the river Carron, passes through the towns of Falkirk and Kirkintilloch, skirts the northwestern district of Glasgow, and joins the Clyde at Bowling, about 12 miles below Glasgow. The Monkland Canal is part of the Forth and Clyde Navigation. That is 12¼ miles in length and extends from the northeastern district of Glasgow to the river Calder. The Monkland Canal was acquired by the Forth and Clyde Navigation in 1846. In 1867 this amalgamated navigation was transferred to the Caledonian Railway Company.

The Union Canal is an artificial waterway extending from Port Hopetoun, in the city of Edinburgh, to a junction with the Forth and Clyde Canal, near Falkirk. It is 31½ miles in length. For 30 miles from Edinburgh the canal is carried on the level, and the remaining distance to its junction with the Forth and Clyde is occupied by 11 locks, each 10 feet in depth. This canal was completed in 1822, at a cost of £461,760. That canal passed into the hands of the Edinburgh and Glasgow Railway Company in 1849, and was transferred with that railway to the North British Railway Company in 1865. For the twelve years shown in my printed statement the average revenue of the Forth and Clyde Navigation was £116,379. There has been a surplus in each of the last ten years. The revenue is not wholly from the canal undertaking; in 1876 the Caledonian Railway got power to make a large extension of the docks at Grangemouth, and the revenue derived from the dock extension is included in my statement. The revenue is mainly from the canal. I would not like to say that the canal is the more profitable part of the undertaking. In the twelve years prior to the opening of the dock the average gross revenue was £93,000; the average for the last twelve years is £116,000. The Caledonian expended on the docks £538,895.

There were three other canals which formerly existed in Scotland. These were taken over by railway companies and abandoned under statutory authority.

There is a very large amount of traffic on the Forth and Clyde Canal. Really the surplus, outside of the dock extension, has averaged about £8,000 a year for the past twelve years. It was said in a statement I have seen that it was paying something like 2 per cent, but I do not suppose that equals it. The Caledonian Railway Company took it under obligation to pay an annuity of £71,000; that was equal to 6¼ per cent upon the capital fixed in the act of Parliament. In the first twelve years I give the traffic was £94,000, and in the interval up till now it has been as high as £125,000. This canal is in better financial condition than any of the others. Its highest summit level is 156 feet.

BRITISH CANALS.

Mr. ARTHUR LEE. Am a manufacturer, engaged in business in Bristol and London. Am one of two witnesses recommended to the royal commission by the associated chambers of commerce. Have given much attention to the question of inland waterways in the last

ten years. Believe the British canal system problem can best be met by legislation which will leave the initiation and management in the hands of some local authorities; do not suggest that such authorities be quite uncontrolled. I think it necessary that local authorities should be compelled to work on some national plan, so that such question as uniformity of gauge, depth of water, and facilities for through traffic should be settled by some permanent authority appointed by the Government, but, subject to this condition, I would leave control in the hands of the local authorities. Continental nations have proceeded on different lines. In France practically the whole inland-waterway system is the property of the state, and the money spent on the improvement of French waterways down to 1902 was found almost wholly by the state, who abolished all tolls on the state canals in 1880. In the report of the select committee on canals in 1883 there is a statement by M. Krantz, of the National Assembly of France. M. Frantz says:

If the canal promotes agricultural improvements, stimulates the establishment of factories, facilitates the working of mines, quarries, and forests, increases, in a word, the public wealth, the state, its inevitable partner, takes its share of all such increased wealth, and that share is perhaps sufficiently large to do away with the necessity of levying any direct toll. It is thus that the state departments have been enabled to construct and maintain roads without demanding any toll from the public who use them. It is this fact alone which, though in a less degree, admits of the existence of these canals from which the state realizes a moiety of the expenses of maintenance. But under such apparently erroneous liberal views lies a true perception of the wants of the country, which induces the state, before anything, to augment its wealth and production, and also a profound equity of taxation for the impost laid upon wealth created by help of the canals diminishes the burdens of the whole community, even of that portion of it which does not make use of them.

My opinion is that it is evident that any expenditure of public money that does stimulate the establishment of factories or the working of mines and quarries in a locality increases the value of land and property in that particular district, and it is my opinion that it is unfair to that part of the community which is not directly benefited to charge the national exchequer with the whole of the cost. This view seems to have been taken by the French people themselves, because in a recent report sent home by Mr. O'Beirne on recent improvements of French navigable waterways he says:

The new French Government's proposal adopts the principle that a part of the burden should be borne by the local bodies interested (departments, communes, etc.). In the case of the continuation of works previously commenced the local bodies may, the law provides, be called upon to contribute in a proportion to be subsequently determined. In the case of new works it is provided that they shall provide at least half the cost.

He goes on to state that the canals will be no longer toll free. The actual tolls are stated in that report. The local bodies are to reimburse themselves by the toll which is allowed to be placed on the traffic.

In Germany they have come to the same conclusion. At the Fourth International Congress on Inland Navigation, held in Manchester in 1890, Mr. Lindley, of Frankfort, said that in Germany—

If a canal was to be constructed, the state alone did not do it; it only undertook the work in case a corporation was formed; it might be a county or the chief cities or the different owners of coal mines interested in the canal, and if they did not subscribe a certain amount of capital the state did not undertake the work.

There is a return from Germany here in which will be found a statement of the way in which different local bodies are called upon to subscribe to the formation of various canals; for instance, "The connection between the Weser and the canal from the Rhine to the Weser, at Minden, is only to be built if the State of Bremen has undertaken to construct at Hemlingen, on the Weser, a weir with a canal, and to pay one-third of the sum of £330,000."

It was stated in the Times of May 2, 1900, in an articles on the canals of Austria-Hungary that "the extensive system of Austrian canalization provided for in the bill of 1901 was, as far as finances are concerned, subject to financial arrangements with the participating provinces and the towns of Vienna and Prague;" and in the report to which I have alluded will be found a statement of the way in which the Government in Austria-Hungary arranges with the local authorities; of how the different canals were financed: in one case it is government grant one-third, the province one-third, the town of Vienna one-third; in another case the government grant and the district interested; another was built wholly by provincial funds and districts interested; in another case the Government supplied 50 per cent of the money and the provinces 50 per cent; in another case the Government 30 per cent and the provinces 70 per cent. The same principle was adopted as in Germany—that inland waterways should not be, as was the case in France for some years, at the sole cost of the state. Continental nations have, after experience, abandoned the principle that these improvements should be at the sole cost of the state.

In Great Britain it has been proposed by some to leave the whole matter to private enterprise; then that the state, while demanding a large local subsidy, shall do the necessary work and maintain full control; thirdly, that the canal system should be controlled by one national trust, which should provide a fund the interest on which should be guaranteed by the treasury; and the fourth proposal is that the local authorities shall be encouraged to form canal trusts and to acquire and improve certain lines of waterways on a definite national plan, but on their own ultimate financial responsibility, although they may receive the assistance of the state. With regard to the first proposal, that is the present position of affairs in the United Kingdom—to leave things as they are, to leave the whole matter to private enterprise. I submit that has been tried and found wanting. The canals of the country under this system have been made and maintained without any settled plan by which national interests might be best served. For instance, take the navigation between the Severn and Birmingham. From the river Avon to Sharpness goods must be carried in boats sufficiently large to be navigated in the tidal waters of the Severn. From Sharpness to Gloucester we have the Gloucester and Berkeley Ship Canal, 16 miles in length, which allows the passage to Gloucester of vessels of about 600 tons burden. From Gloucester to Worcester we have the Severn, 43 miles, on which section river barges can be navigated with maximum dimensions of 135 feet by 22 feet, with a draft of 8 feet 6 inches. From Worcester to Birmingham we have the Birmingham and Worcester Canal, 30 miles long, on which the largest barge which can be accommodated is only 71 feet 6 inches by 7 feet, with a draft of 4 feet. The consequence is that every bit of water-borne traffic between Birmingham

and the Bristol Channel ports must be transshipped either at Worcester or Gloucester.

This Birmingham Canal Navigation appears in the board of trade returns as an independent canal, but I think that designation is quite misleading. That canal system is the key to the whole position as regards the great main routes from the midlands to the sea—not only to the Severn, but to the Thames and the Humber and the Mersey as well. It is entirely controlled by the London and Northwestern Railway Company by an arrangement made in 1846, set out in an act of Parliament—that if the canal company did not earn sufficient to pay £4 per share in any year the railway company was bound to make up the deficiency, and that in any year subsequent to that in which the railway company had to make up a deficiency, they should have a casting vote on the committee of management. Really that guaranty of £4 per share was equivalent to about 10½ per cent on the capital involved. In 1868 the railroad company began making contributions. They contributed in 1869, 1874, 1876, and every year since. It is to the advantage of the railway company to show a deficiency in the canal returns.

Originally these canals were feeders to the canal system. To allow the feeders to the canal system to be railway controlled is like getting at the roots of a tree; you kill the tree. If a national plan were worked out, it would be necessary to take care that the feeders are freed from railway control.

The Cromford Canal and the Ashby-de-la-Zouch Canal were the natural feeders to the Grand Junction Canal by way of Erewash Canal and the Loughborough and Leicester navigations. These canals tap a district in which coal and stone are produced. Their present condition is very bad; the traffic is taken by the Midland Railway Company. That road now own the Grand Junction Canal. The principal railway-owned canals are the feeders of the main routes from the midlands to the ports. They are interposed between the canals on the north and the canals in the south of the country.

I think the difficulty in finding capital to improve the canal system of the country has arisen through the antagonism of the railway companies, whose policy it has been to act as if canals were rivals to be crushed, rather than useful auxiliaries to be encouraged. When capital has been expended on canals in order to reduce the cost of transport between certain points the railway companies have reduced the rates between the competitive points. I suggest that the railways make up their loss from such reductions by keeping up their rates to noncompetitive points. There was some proof of that before the select committee on canals in 1883. The Manchester Ship Canal, although it is a ship canal, illustrates the point; the rates before and after this canal was opened between Manchester and Liverpool. The rate for raw cotton was reduced from 9s. to 7s. 2d.; for grain, from 7s. 4d. to 6s. 11d., etc. That is merely an illustration of how the railway companies cut their rates when the ship canal might be looked upon as an improvement in the canal accommodation of the district. Such competition enables the consumer to reap the benefit of reduction in transport charges. If the cost of improvement of a canal system is borne by private enterprise, the railway rates might be so reduced to a whole district as to prevent the owners from obtaining any return on their expenditure, the whole benefit being reaped by a

local community in a reduction in the cost of commodities. The Manchester Canal has not paid, but it has paid the community indirectly. Then there is the property along the line of a canal which might be improved and rendered available for manufacturing purposes. I think it better that the local authorities should have a hand in the control of the canals, as they are the people who would derive the benefit from that particular betterment. It might be profitable for a rating authority to undertake work which could not properly be carried out by private owners. They would gain in the improvement of ratable value, in the employment of the people, in decreased cost of transport.

The continental nations have now adopted methods under which the state does the work and maintains control, while demanding substantial local subsidies. But there is a difficulty in adopting that system in Great Britain. The conditions are different. On the Continent the ports are fewer as compared with the inland population to be served, and there is less extreme divergence of local interests than in England. There is keen competition between the Belgian ports and the Dutch ports, but that is international competition; but in England we have keen competition between our own ports—the ports of Liverpool, Bristol, London, and Hull, for instance. And, this being an island, a good deal of heavy traffic which in a continental country would be carried through inland canals can be carried from port to port on the sea in England.

I do not think it is true that there is less difference in levels on the Continent than in England. The greatest height attained in France is on the Rhone-Marne Canal, 1,234 feet above sea level, a height not approached by any canal in England. There is a large traffic on that canal. The difference is not so much in levels as in other conditions. Continental harbors have mostly been made at the expense of the state, while English harbors have been made at the expense of local authorities and private companies. In England, if the state took over the control of the inland waterways, there would be a great deal of uneasiness in the ports where large amounts of money have been spent until they knew the particular requirements of each port were likely to be carried out; the argument would be started that one port was being benefited at the expense of another.

Take the Bristol Channel ports, for instance; they are all either privately owned or belong to local corporations. The Bristol docks belong to the corporation of Bristol, and they are at the present time expending something like £3,000,000 on the improvement of the port. An improvement of the waterways between the Bristol Channel and Wolverhampton and Birmingham would be of material advantage to the Bristol Channel ports, but expenditures in that direction might be held detrimental to the interests of Liverpool and Manchester or London and Hull.

These are the reasons, in part, why I think the money should be found by local bodies rather than by the state. I would much prefer local subsidies, combined with local authorities, rather than state subventions. I think that more suitable to this country, and even abroad they are finding the necessity of resorting to that plan. There are parts of the country which could not possibly be benefited, except very indirectly, by a large expenditure on canals, as, for instance, some parts of Wales or the counties of Cumberland and

Northumberland and some on the south coast, and some which have ample waterways on the sea.

I believe there are a great number of canals in England upon which any expenditure would be thrown away. On the map I have put before the commission I have shown certain main-line routes to the Midlands, along which I believe any traffic which would be worth having would come, and I do not think, outside of that, very many canals in the country are worth much. What those who are acting with me desire to see carried out would be a national plan, and it would depend upon the line of routes taken by those who laid down the plan as to what canals should be preserved and what should not. My idea is that a canal which does not connect a largely populated district with a port is no good at all.

My test as to the amount of traffic which would justify the working of a system of waterway navigation would be that it would have to be between points where traffic is likely to be moved in bulk of not less than 25-ton loads as a minimum. In the sparsely populated districts I do not think there is any opportunity for a canal in competition with railways. I know the difficulty in some districts of getting more than 2 or 4 ton lots. Such a district is hopeless for canal business.

I would like to see a selection of canals which would make a national system, but under the control of various bodies who are locally interested in the districts benefited. Still I would like to make them carry out their work according to a national plan.

I would like to call attention to the experience of Holland. Mr. Robinson's report mentions a case in which large agricultural districts were falling into decay, although an almost perfect system of waterways was in existence, and there it was found necessary to provide railway accommodation at the expense of the state because private enterprise in this direction was not likely to meet with adequate remuneration.

In the case of the Birmingham Canal navigations we have large, populous Midland districts as a center served by these canals, and also the ports of Liverpool, Manchester, Hull, Bristol, and London; a large manufacturing population dependent for existence upon supplies of food and raw materials drawn from the outposts. To that population it is of vital consequence to cheapen the transport. The amount of foodstuffs imported into the district of which Birmingham is the center is about 700,000 tons per annum. Roughly speaking, in food, timber, and metals alone this district imports about 3,000,000 tons annually, so that every shilling a ton saved would mean a saving of £150,000 a year to consumers. The canal bill of 1905 does not correspond with my desires. That was a proposal under which the canal system was to be controlled by a national trust. The Government really was to take under its control the whole of the canals of the country and to work them in the public interest, or as an alternative, a national trust was to be formed with a government guaranty, supervision, and control. The interest was to be guaranteed by the treasury. When it began to be worked out into practical form of a parliamentary bill it was found that those who had contended that canals could only be economically useful between thickly populated districts were right, and the measure eventually only suggested that canals along main routes should be taken over,

namely, the Birmingham Canal navigations as a center, Liverpool, Hull, Bristol, and London, and the cross-country routes between Liverpool and Hull and between Bristol and London. I regard the financial proposals as the crucial point. The bill provided that "The interest on guaranteed canal stock shall by virtue of this act be guaranteed by the treasury." That was the crucial point. That was equivalent to placing the whole burden on the state. No provision was made for any local contributions. That is practically the system which was adopted by France between 1878 and 1902 and abandoned in the latter year as unjust to the localities which were not directly served.

The proposal which I wish to be considered is that initiative and ultimate financial risk is to be left to the local authorities who may be encouraged to combine for that purpose. I think there might have to be some compulsion of local authorities to contribute. I would not allow one local authority to stand out and upset the whole scheme. Take the route between Birmingham and the Thames, for instance. I would have one controlling body for the whole of the route. My idea would be, first of all, that a national plan be laid down. Roughly the country seems to divide itself into four different trusts, northwest, northeast, southwest, and southeast, with the Birmingham canals navigation in the center, and I think it must come down to the Thames, the Severn, the Mersey, and the Humber, and the Midland districts. The plan being settled, I would have the plan put before the local authorities and let the local authorities meet and endeavor to combine. By local authorities I mean municipalities and the county authorities. I would allow the initiative to be in any one of the local authorities, and at the instance of any one of the local authorities an appeal might be made to the controlling authority, which might be the board of trade or some other authority. Then, on the initiative of that one authority, I would have an inquiry made and some legislative authority should say what the interest of each of the different local authorities through which the canal ran was—what the percentage should be of each local authority, of representation, and of financial contribution. Then would come in the question of compulsion, because of course you would have authorities on the line of route who would say, "We would be very glad for it to come through, but it is no good to us."

I would have one authority from end to end of a canal. To some extent the conservancy boards of some rivers would be a precedent for that, except that they have not a rating power.

I think it would be just that the state should make some contribution, although certain parts may not be directly benefited, on the ground that the increased ratable value obtained as a consequence of local expenditure carries with it an increased contribution to state taxes. The voluntary system would be the private enterprise, which has already broken down; and if you are to have rating, the rating authority must have control.

I would prefer different trusts or controlling bodies for the systems starting from different ports, because the interests of these ports are divergent and competitive. I think it is to the interests of the community to maintain the present system as far as the ports are concerned. That is a reason why I should wish them to work out their own plans.

I would base the amount of state aid on the probable increase of taxation which would be raised from the districts served as a consequence of increased trading facilities, and subject to the acceptance of the obligation to follow a definite national plan.

If no local authority along a given route took any initiative, I should say that was strong evidence the route was not needed.

In Belgium and Germany the railway system is largely owned by the state, and yet in both countries the policy of the Government is to encourage inland water communication. In the report of Mr. Gastrell on the inland waterways of Germany he says:

> The Prussian Government have always been of the opinion that an extensive and growing canal system is not opposed to the interests of the state railway system; but, on the contrary, the two complete one another, and should work well together in the interests of the public. The Prussian minister of public works has publicly declared that the assistance of the waterways was necessary to the railroads, in order to be able to deal with the rapidly increasing traffic.

In a report by Consul-General Hertslet on the canals and other navigable waterways of Belgium he says:

> This gradual but steady growth of a uniform canal system intended for and serving as an auxiliary to the railways, which are also for the most part under state control, has rendered transport as cheap as possible, and by this means the Belgian manufacturer has been enabled to compete on most advantageous terms with his foreign rivals.

I think in a similar way, as in Belgium and Germany, it would be to the advantage of railway companies in England if the canal system were improved. There was a report of the department of agriculture and technical instruction for Ireland, in which it is pointed out that "the growth of a canal trade may be accompanied by an increase in the traffic and profits of a competing railway, and an instance of that is afforded by the canalization of the Main from Mayence to Frankfort. The Main improvement works were completed in 1886." A table is given showing the tonnage by rail and by water for the three years before and for the three years succeeding the canalization of the Main. The moral of the table is that coincident with the increase of traffic on an improved waterway there can be an enormously increased freight on a competing railroad. The same thing has been found in Manchester by the increase of general trade of the district, brought about by an important canal system, which has brought increased trade to the railways. It is generally believed that a great deal of the heavy mineral traffic is carried by the railways at a loss. In a statement handed to the select committee on canals in 1883 by Mr. Francis Conder, he estimated that the loss to the shareholders of railway companies on the carriage of coal to London alone amounted in 1877 to £822,000 a year. I have not seen that contradicted. Railways must satisfy their shareholders, and if there is a loss made on the heavy traffic they must make it up in other directions by charging higher rates than would otherwise be necessary between noncompetitive points and on classes of goods not suitable for conveyance by canals. The policy of railway companies with regard to canals has resulted in a loss to the whole community. I think it would be an advantage to all parties if the railways dealt with the traffic which needs quick delivery and can bear comparatively high rates, leaving the heavy traffic to the canals. If we adopted the system which is adopted abroad and allowed canals and

railways to work together it would be better for the whole community.

At a meeting of the International Engineering Congress held in New York in 1904, Mr. Leo Sympher, of Berlin, sent a communication relating to the traffic on the Oder Spree Canal, showing that in 1890 the small, unimportant canal had a hard struggle to maintain itself. In 1890, the year before the improved waterway was opened, the traffic carried by rail between Opeln and Berlin amounted to 1,849,000 tons and the canal traffic to 243,000 tons. In 1902 the canal traffic had increased to 1,895,000 tons and the rail traffic maintained its tonnage at 1,812,000 tons. The canal is not only paying its maintenance but is returning 2 per cent on the capital invested.

At the conference Mr. Edward P. North, a well-known engineer of the United States, gave the average rate received by railroads of different countries for transporting a ton of freight per mile, and that, reduced to cents, he gave as: United Kingdom, 2.80; Italy, 2.50; Russia, 2.40; France, 2.20; Germany, 1.64; Belgium, 1.60; and Holland, 1.56. I would like to point out that the United Kingdom is at the top of the list, and that the countries that have the best system of waterways pay the lowest rates of freight all round.

In the report of Consul-General Hertslet on Belgium he gives a comparison of the freights for 1888 and 1903 on coal. By his table it appears that barge owners have been able to make very large reductions in rates in consequence of the improvement of the canals in Belgium. The rate, for instance, from Antwerp to Cologne, 256 miles, in 1888 was 6s. 7½d. In 1903 it had been reduced to 2s. 3d. for 50-ton lots. That is by canal. The rate from Antwerp to Mannheim, 418 miles, partly by river and partly by canal, in 1888 was 9s. 2d., and it has been reduced to 4s. 6d. in 50-ton lots. There are here the rates to a number of the principal towns in France, in Belgium, and in Germany, and all the rates bear out the assumption that a very great reduction has been made between 1888 and 1903 in the cost of transport by canal. One reason for this reduction is that they have been enabled to use larger barges.

In the Transactions of the International Engineering Congress, 1904, Mr. E. P. North, of the United States, says:

> The highest freight rate during this period was, in 1885, 1.157 cents, and the lowest, 1899, 0.726; since which time the rate has increased by about 5 per cent to 0.764.

That is the average freight rate in the United States over the railways.

I do not think it possible to make canals profitable for purely agricultural districts. You will not get a farmer to send away his products in 25-ton lots, nor can you get them to cooperate. You can not stop a barge for a small lot of traffic as you can knock off a truck on the railway.

The French canals before 1868, the majority of them, were in the hands of the state, I believe, but they had been neglected, because it was generally supposed in France that canals would be useless when railways were begun; but they woke up to the fact in 1868, and thereafter the canals were necessary as complementary to the railways.

In England the railway companies still think it is not desirable for them to get rid of their heavy traffic, even on their own canals.

Mr. JOHN ARTHUR SAXER. I am a member of the Institution of Civil Engineers, and for many years have been engineer of the Weaver Navigation. I am the author of the paper which is in the hands of the commission on the "Waterways of Great Britain," which was read before the Institution of Civil Engineers November 14 last. I received a Telford gold medal from the Institution of Civil Engineers.

The first thing I wish to bring out is the inadequacy of the present canals. In the first place, they have no uniformity of gauge. Some of the boats are 7 feet wide and some 14, and others much larger, so that it is impossible at present to go from one point of the country on a through route to another without break of gauge; that is to say, it is impossible to go, for instance, from Liverpool to Hull without break, or from Liverpool to Birmingham.

One effect of this is to make it difficult to get through rates: the companies are in different hands and there are different companies to deal with. So far as I know, at present there is no means of getting through rates except in one or two instances. And then, a few companies are carriers, but most of them are simply toll takers. The Aire and Calder, and the Leeds and Liverpool, for example, are carriers. Take, for instance, the route from Liverpool to Birmingham. There is the Manchester Ship Canal and the Weaver, with 42-foot locks; then there is the Trent and Mersey Canal, with only 7-foot locks.

The smaller boats are largely worked by men and their wives and families who live on board, and they have a horse to tow the boat. The cost varies from about two-thirds of a penny to twopence a mile per ton in those boats, exclusive of tolls, repairs, and owner's profit; that is merely what is paid to the man. The cost varies with the nature of the cargo; one can get less on his boat if the cargo is bulky; he would get more on coal and less on cotton. The figures I have given are of the actual cost of running the boat.

With a few exceptions, these small canals with narrow boats as they now exist, can not compete with railways for the lower classes of traffic. They can compete with the higher classes—that is, more fragile goods.

The next difficulty is want of coordination and centralized management. That, of course, is partly due to the difference in gauge and the short lengths owned by different companies.

The other difficulty was the action of Parliament, and, in some cases, of the canal companies themselves, in allowing railway companies to buy the connecting links of through routes. The Aire and Calder dates, I think, from 1699, and the Weaver from 1721. The locks of the former were built between 50 and 60 feet long, and the Weaver 90 feet. Apparently it was recognized even in those early days that smaller locks were not economical. The Aire and Calder was 14 feet 6 inches wide, and the Weaver 18 feet. Still the Trent and Mersey, constructed toward the end of the eighteenth century, was made 14 feet gauge at each end and only 7 feet wide between Burton and Middlewich—that is right through the pottery district. Doubtless it was a difficult district to deal with and they ran short of money. I do not think, however, broad-gauge locks and aqueducts would have added much to the cost in the first instance.

An unnecessary expense is caused by each separately owned bit of canal maintaining its own staff. There would be great economy in amalgamating the little companies together. There would be no difficulty in forming them into large groups—one for each of the large watersheds of England, for instance. There is an Association of Independent Inland Waterways. I had a letter from its secretary, saying they were really trying to bring about amalgamations and to work together as far as possible. I believe they are continuing to do so. I think they have been mainly concerned in endeavoring to arrange through rates of toll and settling the amount of toll. I can not say whether that includes arranging with the carriers for through rates.

In the opinion of the railway companies, apparently, it is better to lose money on the canal in order to divert traffic to the railway. In the case of the North Staffordshire Railway, by the board of trade returns for 1898 it appears as if the railway company were losing £30,000 a year on the canal—that is to say, the profits from the canal itself do not meet the liabilities of the railway company to pay the interest on the original capital by £30,000 a year.

I am surprised that some of the railway companies owning canals have not developed the canals instead of doubling their tracks. I think it would have paid some of the companies to do so; for instance, the London and Northwestern Railway and the Shropshire Union Canals, the main line from Wolverhampton to Ellsmere Port. The cost of improving that canal would probably have been less than improving the railway. The delivery by water is not appreciably slower than by rail for ordinary traffic. The time of delivery of parcels, for instance, from London into Cheshire now by rail is four or five days, unless it is very urgent, and the canals could certainly deliver it in that time. The old fly boats, as they were called, used to come through from London to Cheshire in three days, traveling night and day. You can draw up anywhere on the side of a canal and deliver cargo without maneuvering for a siding, as in case of a railway.

The figures in my paper, giving the free canals 2,768 miles and the railway-owned canals 1,138, are not to be taken without some explanation. In the statistics I took these from—the board of trade returns—the Birmingham canals were put under independent railways. In the discussion which followed it appeared they are really railway controlled. The Birmingham navigations are 158 miles long, so 158 should be deducted from the total of free canals as given and added to the railway controlled.

In my paper I state that the only navigations which have really moved with the times are the Aire and Calder, the Weaver, and, in a less degree, the River Severn, the Grand Junction, and the Leeds and Liverpool canals.

### THE WEAVER CANAL.

The Weaver Canal is practically an artificial canal for its whole length of 20 miles; the river has been so improved that it has become a canalized river and practically a large canal all the way. Floods are dealt with by means of large sluices and have no effect now on the traffic beyond slight delay. The Weaver originally was an unnavigable stream, partially tidal, running through the center of

Cheshire and through the large salt districts of Cheshire. In 1721 an act was obtained for making the river navigable, and about ten years later operations were commenced with the locks. Since then it has been gradually improved until now the locks are able to take 4 vessels carrying 250 tons each, say 1,000 tons, at one locking down the river. Every lock is capable of taking a train of boats. The locks are 42 feet 6 inches wide and 220 feet long, taking 4 vessels, 2 abreast; then we have a second lock, alongside the larger locks, for taking 2 boats only, 1 boat behind the other. We take 1,500 tons through at one locking with the two locks. Those barges are about 90 to 95 feet long, 21 feet beam, and draw 10 feet 3 inches. They carry from 80 up to 320 tons. The ordinary steam barge carries 250 tons and is fitted with steam derricks for loading and discharging from the shore. There are one or two barges running up to 450 or 500 tons. We do not have many cranes on the shore except at the terminus.

We have a hydraulic lift, called the "Anderton lift," for raising boats from the Weaver to the Trent and Mersey Canal. There is a large trade with these narrow boats, which come down the Weaver from the potteries and take cargo back, and they are transferred by means of this lift, lifted through 50 feet. The boat goes into a tank, the gates are closed, and the whole of the tank and the water are lifted up through the whole 50 feet, so there is no loss of water. That lift was constructed in 1875. It has always worked well. If the boats are in order—that is, one going down and one coming up—it does not take more than twelve minutes for each operation; the actual lifting is about seven minutes. The question of water loss is entirely solved by the use of these lifts. If you place two or three of these lifts on either side of a summit of the route of a canal, the only loss of water is that due to leakage and evaporation. But for this lift we would require five or six locks to overcome that 50 feet, and it would take as long to go through each lock as through the lift. This is the only vertical hydraulic lift in England. At Foxton, on the Grand Junction Canal, there is an inclined-plane lift, where the tank is drawn up an inclined plane by wire ropes. That type of lift has been used only for boats up to 100 by 14 feet. So far as I know it works satisfactorily. It has been used five or six years. In the German lifts the boat is taken out of the water. The Dortmund Ems Canal lift is buoyed on pontoons. At Anderton, on the Weaver, the tank is balanced on the top of a single ram about 3 feet in diameter, with hydraulic pressure of about 700 pounds to the square inch, but the one on the Dortmund Ems, at Henrichenberg I think, is balanced on five circular buoys or pontoons, and these have just sufficient buoyancy to counterbalance the weight of the tank and the water in it, and the tank is operated by means of vertical screws wound round by electrical motors. There is no hydraulic machinery beyond the fact that these pontoons are submerged. When the boat goes into the tank, it does not affect the weight of the tank of water, because the boat displaces from the tank its weight of water. Then there are four screws at each corner, and as these screws work round they screw this thing gradually up, so that the amount of power required is only that required to overcome the friction of those screws.

The cost of the Anderton lift was about £48,000, including the land, in 1875. I do not think it would cost so much now. The land cost

is a great part of it, and they got into trouble with the foundations. With good foundations it would cost much less. It sounds like a large sum, but the cost was not so much as the five or six locks it takes the place of. The cost of working is small; it requires one or two men in attendance, skilled men.

The cost of carriage on the Weaver, carrying cargoes of Class C, is about 0.3d. per ton per mile; if you have bulk goods it is 0.2d. per ton per mile. With bulk goods you can get more into a boat than with light goods. The 0.2d. figure makes allowance for the fact that sometimes a steamer runs with part cargo, and is sometimes delayed for cargo. Otherwise it could be figured out lower. My rate of 0.3d. on Class C is based on a general average over twelve months of certain steamers, some carrying many barges and some few, some delayed and some not delayed, some fully laden and some half laden. If you had a regular flow of traffic, it might figure down below 1s. 10d.

The costs I have named do not include the canal tolls; it includes the repairs of the steamer. It is the cost to the owner of the steamer, not to the canal company. The toll on the canal has to be added. It does not include loading and unloading. With a train of four boats, with the most economical towage I know, I should say 0.08d. would be the lowest figure. I think that compares with the Belgian costs; it is about the lowest the Belgians can do it for. I select Class C goods because we have more of that class. I have obtained these figures from the carriers. The 0.3d. includes upkeep of the boat and interest on its cost and depreciation.

The carriers' charge to the traders for timber, which is in Class C, from Liverpool to Northwich, 36 miles, is 6s. 6d. per ton by rail and 4s. by water. There is a great difference between the volume of our up and down traffic, so that boats going full in one direction return comparatively empty. These costs are based on no back cargo. The tolls on the Weaver are between 10d. and 1s. per ton for Class C for the whole length of the river. I could not give the rate per ton mile; but as the Weaver is 20 miles long 10d. would be about half a penny per ton per mile. With a long waterway and a return traffic these costs might be considerably reduced. In the classification all the maximum tolls commence with the first 10 miles and are smaller for subsequent reaches.

Q. Take a great river like the Rhine, with their big boats of 2,000 tons, running from Rotterdam to Mannheim. I was told the other day at Mannheim that they are paying a rate of 1s. 10d. for grain carried from Rotterdam to Mannheim, that is owing to the length of the run, the size of the boats, and competition. That would reduce the rate to that extremely low figure?—A. Yes; that would reduce it, because you would go ahead without any stoppages when it was once in the boat.

There are arrangements for very rapid loading at Rotterdam and loading at Mannheim, so the boat lies idle a very short time.

In Mr. Bartholomew's figure of one thirty-fourths of a penny on the Aire and Calder, I think he has taken only the actual cost of a full cargo; and he has great facilities for handling that coal direct from the colliery to the vessel. We have not the same facilities on the Weaver.

These better canals, the Aire and Calder, the Weaver, and the Leeds and Liverpool, are more profitable than the others, as shown by the

returns. There is no doubt that canals of the size of the Aire and Calder and the Weaver would pay very well indeed. The Weaver does not pay a dividend, but it could pay 5 per cent if it was in the position of an ordinary company. Until 1896 the whole of the profits of the Weaver had to be, by act of Parliament, handed over to the county of Cheshire, and from 1796 to 1880 I believe they handed over a million pounds in profits. There was a reconstruction in 1896, and since that time the profits have to be divided, so as to form a reserve fund before any is handed over to the county.

### USE OF PUBLIC MONEY FOR CANALS.

I think it is almost self-evident that if the cost of transporting goods from the ports inland and vice versa can be reduced there is a certain gain to the trader, to the commercial community, which is a gain to the country generally, not only as being more prosperous, but also as improving the amount of income tax which can be raised. That is an argument in favor of using public funds as they are used in foreign countries for improving waterways. The case of Manchester and the Manchester Ship Canal, I think, clearly shows the importance of reducing the cost of transport. When I first knew Manchester the ship-canal bill was in Parliament and Manchester had an appearance of decay; everyone was complaining about trade. Now, since the ship canal has been built and this large amount of traffic has been able to get up at reduced cost, Manchester has been very greatly improved, and you hear people say that things are very much better. That would point to an expenditure of public money to connect with seaports, by means of waterways, places where there is a large population and where there are industries. I have made on a chart a suggestion, to connect, first of all, the four ports with the Midland district, and then to connect Liverpool and Hull by a cross-country route. That would place a very large number of people in direct water communication with each other. For instance, if you take the route from Liverpool to Hull, on the banks of that canal, including Goole, Leeds, Wakefield, Bradford, Huddersfield, Barnsley, Rochdale, Oldham, Manchester, and Salford, you would have a population of over 2,800,000 which would be served by that canal. Then from Liverpool to the Midlands you would have a population of 1,600,000; and from Bristol to the Midlands you would have 1,600,000.

In any scheme for taking over the canals, or for controlling them from a central body, one would have to differentiate between canals of considerable importance, those of less importance, and those of no importance. I have divided the canals into four different classes.

Class A consists of those which require practically no improvement. In that I include the main line of the Aire and Calder Navigation, from Hull to Leeds; the river Weaver, the river Severn, the Gloucester and Berkley Ship Canal; the Exeter Canal, the Medway Lower Navigation, the Ouse and Foss Navigation to York, the Lower Ouse Navigation, the Caledonian Canal in Scotland, and the Ulverston Canal. Those are the canals in the country which would take a standard 300-ton barge or a 250-ton steamer. These are all navigations, natural waterways, except the Gloucester and Berkley Canal. I have purposely left the Manchester Ship Canal as apart altogether.

I have an alphabetical list of canals it would pay to improve. They are: The Aire and Calder, the branch to Barnsley; then the Birmingham canals—I am assuming that in this case the suggestion in my paper is to be considered; that is, to connect the Midlands with the four ports. The Birmingham canals might be gradually improved after the completion of the main waterways. The Birmingham and Frazeley canals would form part of the main route from the north. The Bradford Canal would serve the town of Bradford. The Calder and Hebble would form part of the cross-country route from Hull to Liverpool. The Coventry Canal would form part of the route from the north. The Grand Junction Canal would form the greater portion of the route from London; the Leeds and Liverpool Canal from Leeds to the junction with the Bradford. The Newark Navigation would be part of the Trent improvement, all part of the route from Birmingham to Hull. There would be a short length of the Oxford Canal to improve. The Rochdale Canal would form part of the route from Hull to Liverpool. The River Don Navigation would be the connecting link to Sheffield. The Stafford and Worcester Canal would be part of the routes from Liverpool and Bristol to Wolverhampton. The Trent Navigation would be part of the route from Hull to Birmingham. The Warwick and Napton and the Warwick and Birmingham Canal form part also of this same through route. Then you would have the Huddersfield Canal, and the Trent and Mersey Canal, which is railway owned, would form part of the main line from Liverpool and Hull to the Midlands.

I put down the Forth and Clyde Canal as being one that would pay to improve, not as a barge canal, but as a ship canal, so that it would place Glasgow within a very much nearer distance of Hamburg and the European ports than it is.

It is to the canals in this class of which I have just spoken that I would be inclined to apply public money for their improvement. In undertaking the improvements I think I would commence by connecting Birmingham with Bristol and with Liverpool. The approximate cost from Birmingham to Bristol would be £1,680,000 and from Birmingham to Liverpool, £2,220,000. That would improve canals which already have a tonnage, including the Birmingham tonnage, of nearly 11,000,000 tons per annum, and I think you would have no difficulty in saving at least 2s. on each ton.

It is not often realized that 50 per cent of the weight of a goods train is tare weight. With a train of barges you can carry 1,200 tons with a tare of only about 300 tons, as against 1,100 tons on the railway. Then canal boats go steadily ahead, with no waiting for sidings. They can certainly deliver as regularly as railways and in most cases as rapidly. The first cost of a plant required to carry goods is less on a waterway than on a railway. Supposing you require two trains or 75 wagons to carry 600 tons on the railway; you have two locomotives, at a cost of £12,000, whereas the cost of a steamer and barge is only about £5,050. And then if you consider 1,300 tons, the train would be about £24,000, while a steamer and three barges would only be £8,000. The cost of repairs of the steamer and barges is less than the repairs of the wagons, to say nothing of the locomotives. For a 1,300-ton load for a steamer with two barges

you would require 9 men as against 12 by railway. There would be one skilled man in each case.

The upkeep of the permanent way of a railway probably varies between £500 and £600 a mile. The cost of maintaining such waterways as are suggested by me would certainly not amount to more than £200 a mile, exclusive of management and lock keepers, or, to include them, £300 to £400 a mile.

The cost of maintaining the Belgian canals, as I learned at a canal congress in 1898, is from £300 per mile down to about £130; on rivers, averaging about £100. These figures are exclusive of the salaries of officials and office clerks, for which about one-third must be added. At that time, at any rate, there was not much mechanical towage on Belgian canals; it was chiefly done by horses and men.

The cross section of my proposed standard size of canal would show 8 feet draft, 40 feet bottom width, and about 80 feet top width. Foreign countries have chiefly 2 meters depth. I should not propose to take vessels drawing more than 6 feet 6 inches up to Birmingham. With steam propulsion you need more water under them than when towed by horses. Another point in keeping the draft small is that the empty steamers have to pass under many bridges, and you have to keep them small enough to get under when light. The locks would be large enough to take two of the proposed vessels at one locking, a steamer carrying 250 and a barge 350 tons. I should keep them narrow, not more than 22 feet wide, 230 feet long, with 7 feet depth on the sills, the depth in the lock being 8 feet. In these locks it would be possible to get two vessels 110 feet long by 21 feet 6 inches beam and 6 feet 6 inches draft. A barge of that size would carry 350 tons, and she would have a tare weight of 65 tons. The cost of such a barge would be £1,750. That is a dumb barge. A steam barge would be of the same dimensions and carry 250 tons. She would have a speed of 5 miles an hour and would have a tare weight of 107 tons. The cost of the steamer would be £3,300. Two men would be required on the barge and three on the steamer. The steamer would also be fitted with a derrick and steam winch for loading and discharging, so fitted as to be lowered when passing under a bridge.

Take a single steamer carrying 250 tons on a 100-mile round trip. If she were to make three trips in a fortnight, the captain, mate, and driver's wages, together with the fuel and other stores, and depreciation and repairs, for a fortnight would be £43. That per ton per mile carried, cargo one way only, would be 0.144d. per ton per mile of serviceable miles. Then if you add a barge to that you only add a very small amount to the cost, and it brings the cost per ton down to 0.073d. per mile. Comparing these figures with those reported for French and German canals, they are not unreasonably low.

In the Weaver area glass in crates for a distance of 30 miles pays by railway 17s. 6d. a ton and by water 7s. 6d. Probably accounted for that the risk of breakage is less by water. The rate from Stoke to Liverpool, general classification, is 9s. 6d. by rail and 5s. 6d. by water. For iron and steel, 5s. by rail from Stoke to Northwich and 3s. 9d. by water. These are for short distances. I have tables for Hull to Nottingham, Hull to York, and Hull to Leeds, and they all show the water rates are now at least 20 to 25 per cent below railway rates.

I would propose that all the waterways taken over should be placed in control of one central body or board. That board should have full

control of all waterways under its care, full control of the funds, and would have to give permission for any alterations. There might be one administrative committee for each of the great watersheds.

I do not know of any case in England where treasury money has been given to a transportation system. It has been done in Ireland and Scotland.

I have been of opinion for many years that it would pay the country well to develop its inland waterways. I am afraid there is no hope of its being done by private enterprise. Until some canal shall be made which will show what can be done, it will be difficult to get capital.

I believe it is true that in France very extensive works have been carried out at the cost of the state, and been but little used. I have heard that the French Government is no longer disposed to spend very largely on waterways unless the local bodies will make contributions.

PROPOSED CANAL SYSTEMS—ENGLAND.

Mr. Henry Rodolph de Salis. I am a director and deputy chairman of the firm of Fellows, Morton & Clayton (Limited). They are the largest canal carriers in the United Kingdom. I am an associate member of the Institution of Civil Engineers and the author of "Bradshaw's Canals and Navigable Rivers in England and Wales." Am also a county councilor for Buckinghamshire. The county council have nothing that they wish to bring before the commission, but have requested me to answer on their behalf any questions the commission might like to ask.

My firm has its headquarters in Birmingham. Our business extends as far south as London and as far north as Manchester. We carry on all the canals forming the route between Birmingham and London—that would be the Grand Junction, a portion of the Oxford, the Warwick and Napton, the Warwick and Birmingham, the Birmingham Canal navigations—and then we also trade over the Leicester section of the Grand Junction Canal. I have made a personal inspection of the whole of the inland navigations of England and Wales. It took the whole of my spare time for eleven years, and amounted to a mileage of 14,340 miles. That ended in 1901. The total mileage of waterways described in my "Bradshaw's Canals" is 3,915, of which 3,073 is nontidal. The Board of Trade's Return for 1898 gives the total as only 3,167. Of course it is difficult to define exactly what constitutes inland navigation.

What I propose to dwell upon are the connected waterways, which affect the system of communication as a whole. I do not propose to say much of isolated waterways or isolated groups. My idea is that canals in rural or sparsely populated districts are of little use; such districts are not suitable for canal traffic. In my experience in such a district a canal is not of much use to agriculture. But where there are important manufacturing centers, large towns, and the ports are connected by waterway, the case is different.

I have 11 routes which I consider of primary importance to improve, and 4 others which might receive secondary attention.

I think experience shows there is considerable vitality in the waterways of England; I think it would be hard to find any other industry which has managed to survive so long in almost its original state. I think the first cause which has operated to prevent improvements is the excessive number and varied constitutions, duties, interests, and procedure of the numerous authorities who control them. The large number of companies on a short route is very conspicuous. Amalgamation would be very beneficial. We have as controlling authorities canal companies who are carriers and those who are not, railway companies, dock companies, boards of conservators, navigation trustees, private individuals, and, in some cases, no authority at all, as the river Trent below Gainsboro, 26 miles. Under these conditions the interests of navigation are not always of first consideration; so many of the authorities have so much else to think about. A river conservancy, for instance, must look out for the riparian owners, pleasure-boat people, bathers, and fishermen.

There has never been any effort at combination of canal owners that has amounted to anything. The chief defect in that line is that there is no canal clearing house, such as railways have, which leaves every boat owner practically to deal separately with every navigation over which he trades. It is only quite lately that the Grand Junction Company, by arrangement with the other canals that form the through route between London and Birmingham, have been enabled to quote through tolls between those cities. Then there is great want of united action in regard to repairs. It is an old custom to stop canals for repairs on bank holidays. One part of a through route will have a stoppage at Easter, another at Whitsuntide, and another at August bank holiday, which certainly is not to the advantage of the trader who wishes to get through. One part of a through route will refuse to break the ice, and others will say, "It's of no use for us to break ice unless so and so will do so." Some parts of through routes have modern appliances for repairs and others have not. The Manchester Ship Canal, in respect of their Bridgewater Canal barge system; the Grand Junction; the North Staffordshire Railway Company's Trent and Mersey, and the Leeds and Liverpool have all modern plants and machinery for executing repairs and dredging.

I believe railway ownership is undesirable, as being inimical to canal development, but I would hardly like to go so far as to say that it is the policy of the railways to strangle trade on canals in their possession. I think the policy of railways toward canals they own is, as anyone might expect, exactly what suits them best in each particular case. There are some railway-owned canals which compare favorably with any independent canal; for instance, the Trent and Mersey, of the North Staffordshire Railway, and the Lancaster Canal, of the London and Northwestern. In spite of the obligations imposed on railways by the railway and canal traffic act as regards maintenance in good order, there are ways of choking off trade, by such means as indifference to requirements of traders, the imposition of maximum tolls in all cases, and frequent stoppages for repairs. I have seen certain portions of railway owned canals entirely unnavigable.

Sometimes authority is divided, as in the case of the Thames above Long Whittenham. In addition to the many duties carried out by

the Thames conservancy, the Thames Valley drainage commissioners have a separate drainage jurisdiction. In other cases mill owners exercise certain rights, although a good many of them have been bought out. There is one instance on the river Stort where a toll of sixpence for every vessel passing through a lock is payable to the occupier of a mill in addition to the navigation toll.

I think one of the first steps to be taken in the direction of reform is to greatly reduce the number of controlling authorities and to take away all jurisdiction of authorities adverse or indifferent to the development of navigation. I advocate the acquisition of waterways by the state. I think the state is the only possible authority that can do anything toward bringing them into line. I would not have the state acquire all the waterways, but the useful lines, particularly the main lines, so that long-distance traffic would be under one authority.

The second great evil and as great as the first—the multiplication of authorities—is the great difference in the gauges. Setting aside for the moment the three ship canals—the Manchester, the Gloucester and Berkeley, and the Exeter—the gauge of the canals varies from that admitting boats measuring 72 feet by 7, with 2 feet 6 inches to 4 feet draft, up to the Aire and Calder, and the Sheffield and South Yorkshire Junction Canal, which have locks giving a capacity of 120 feet by 17 feet and a draft of 7 feet 6 inches. Of course, the smallest unit in a route limits the capacity of the whole for purposes of transport. Almost all the through routes between important centers have narrow links of canal. Nothing but a narrow boat can navigate between London and Northampton, London and Leicester, London and Nottingham or Manchester, and nothing but a narrow boat can get into Birmingham from anywhere. If we undertake to take our narrow boat from London to Leeds, we shall fail altogether, as we shall be stopped at either Wigan, Sowerby Bridge, or Cooper Bridge by the locks on the Leeds and Liverpool Canal or Calder and Hebble Navigation, which, although of twice the width required by the narrow boat, are 10 feet too short, and the narrow boat is not safe to send on wide estuaries or tidal waters.

I would suggest that the desirable unit to which barges be reduced would be the 60-ton barge, as that commonly existing on the barge canals is of the same length of the narrow boats and twice the width, roughly, 72 feet by 14. For the most important main lines I would suggest locks capable of taking three such boats, with three pairs of gates; the barges in length would be one behind the other in the lock; and if you had an intermediate pair of gates at two-thirds of the distance, you would then be able to make a pen for one, two, or three boats without any undue waste of water. Such a lock would be about 230 feet by 14. Many of the canals could be sufficiently widened by making their walls vertical instead of sloping, building them up with brick. If widened otherwise, you would often have to do away with the towpath or buy more land. The Grand Junction canals are at present constructing several miles of walling, practically perpendicular, on the Paddington branch. Mechanical haulage is out of the question on many of our narrow canals as at present constructed. The advantages sought by mechanical haulage are greater speed and greater loads. The speed of a boat in a confined channel is limited

by the ease with which the water can move past the boat. If you undertake to increase your speed you are perpetually climbing up a slope of water, and you create a breaking wave which damages the banks of the canal. And in the narrow canals mechanical haulage can give you greater loads only by employing a tram of boats, and of course where you have only locks for single boats there is great delay.

Our company has about 240 boats, of which 20 are narrow steamboats. The ordinary boat, such as we have, carries about 28 tons, and when it is fitted up as a steamer it carries about 17 tons. The dimensions of the steamers are 71 feet by 7 feet 1 inch; depth, 4 feet 2 inches; draft, loaded, 3 feet 6 inches. All these steamers are practically engaged in the London and Birmingham trade. The steamer and the boat which it tows are locked at one locking on the greater part of the route.

I do not look with favor on petrol as a source of power on account of the danger of fire. A petrol fire in a tunnel might lead to a disaster awful to contemplate. I have seen a tow of as many as 23 boats in the Blisworth tunnel on the Grand Junction.

I think there is effective competition between carriers on English canals. I have never known of any combinations in order to arrange profitable rates. Even on canals owned by carriers other carriers run their boats, although the canal owners in such case usually do the bulk of the business. The only case I think of in which a railway company carries on its own canal is that of the Shropshire Union Railways and Canal Company.

With the larger barges and larger locks such as I have suggested I think it would be feasible to compete with the railway companies in carrying low-class traffic at low rates. But at present that is not the kind of traffic we can do to any great extent.

## THE FORTH NAVIGATION, SCOTLAND.

Mr. David Buchan Morris. I am clerk to the commissioners of the Forth Navigation. That is a statutory body, constituted under an act of Parliament. The commissioners consist of the whole town council of the burgh of Stirling, 21 in number, together with six county representatives, appointed, two each, by the county councils of Stirlingshire, Perth, and Clackmannan. The jurisdiction of the commissioners extends over the river Forth from Stirling down to a point about a mile above the harbor of Alloa, about 9 miles. The act of 1843 gave the commissioners powers for the construction of a quay at Stirling and for deepening certain fords or shallow portions of the river. Those works were carried out at a total cost, from first to last, of about £7,700 for deepening operations and £4,000 for the construction of the quay. The expense was met partly out of revenue and partly out of sums received by the commissioners from the corporation of Glasgow as compensation for water abstracted from the river Teith, a tributary of the Forth, for the water supply of Glasgow. This abstraction of water lessened the flow in the river at times, and the compensation money was applied by the commissioners in deepening the channel, so as, for navigation purposes, to make good the deficiency. The tidal water extends about 3 miles farther up the river than Stirling. Vessels come up the river to Stirling on the

flow of the tide and go down on the ebb. The harbor at Alloa is outside our jurisdiction. The revenue of the commissioners consists of tolls upon goods and dues from passengers carried on the river and dues on vessels. These tolls are charged according to a scale, and the maximum charges are fixed by the Forth navigation acts. There are various owners of shipping which comes up to Stirling. The commissioners do no carrying. The commissioners have a capital sum of £3,750 invested. That is the balance of the compensation money received from the Glasgow corporation. There is no debt. In earlier years the total sums collected from dues was much larger than since. The falling off represents the effect of railway competition to a large extent. Our largest revenue was in the year 1849–50, and amounted to £770. The receipts for the year 1904–5 were £192. Vessels drawing 11 feet can go up to Stirling on stream tide. The one outstanding cause which has prevented the development of the Forth in recent years is the railway bridge over the river near Alloa. But for that the commissioners would be prepared to expend some money in improving the river.

## ENGLISH CANALS AND CANAL BOATS.

Mr. Owen Llewellyn. I am an inspector under the local government board in connection with the canal boats acts. My statistics are taken from over 300 annual reports. Every canal having boats used for sleeping purposes is represented. My latest statistics show 12,782 canal boats used as dwellings. That includes all boats used as dwellings, or which could be used as dwellings, which the owners wish to register. Of course there are some boats with cabins which are not registered, and there are some boats with cabins which are registered and not used, but I try to get the owners to give up the registration of them. That total includes many which are not used—a great number which we can not trace at all. A great number are now strengthening the sides of canals. Some are blocking navigation in many canals; sunk or used for other purposes.

The boats belonging to the larger companies as a rule keep regular routes; of course some of the routes are cross-country routes, but on the whole you generally know where to find them at certain times. It is the smaller companies and the privately-owned boats that wander about where they can pick up a cargo, where living is cheap, and for many other reasons. I think we may say that the business is generally done by the smaller firms.

I think the number of cabin boats in the midland counties is diminishing. I understand that on English canals there is a lock every mile and a quarter on an average. That takes in South Wales, where the canals are mostly locks. The locks leak to a great extent.

The locks sometimes come in flights of 10 or 12, and the boatman has to work them himself; he has to get the boat into one lock, and send the wife on to open the next lock, and maybe the child on to draw the paddles of the lock above that; then the boat is left to its own devices to get through with the horse and the steersman. So long as the water is at winter depth the boats go along all right, generally, but in the summer whenever the water is a bit low there is difficulty. In the Leeds and Liverpool Canal navigation is stopped two or three months in the summer. The Great Western Kennet

and Avon Canal, which is a very good canal and wider than most of them, has occasional shortness of water. A friend of mine, Sir Roger Palmer, has a canal boat fitted up like a yacht. He has to apply for leave to seven or eight companies simply running from Llangollen to Maidenhead. There are more derelict canals owned by independents than by railways. Generally those owned by railways have been kept up. I am told in many places canals have had their water supply diminished by the company parting with its rights; there is so much more demand for water now that a reservoir originally constructed for canal purposes may often be more profitably used otherwise. Barge traffic is most successful where there are fewest locks. Some canals derive considerable revenue from fishing.

An enlargement of the canals would involve enlargement of the tunnels, which would be very expensive. That applies to some of the main routes; for instance, between Birmingham and the Severn, between Liverpool and the Potteries, and between London and Birmingham. I do not think canals are very useful to argiculturists except for watering cattle.

### THE TRENT AND MERSEY CANAL.

Mr. William Douglass Phillips. I am general manager of the Northern Staffordshire Railway and of the Trent and Mersey Canal. That canal runs right across England from Derwent Mouth on the river Trent near Derby to Preston Brook, where it joins the Bridgewater Canal, along which the traffic passes for about 6 miles to the port of Runcorn on the Mersey. The distance is 93 miles. There are various short branches which are very valuable as feeders, bringing up the total length of canal to 119 miles. The powers were given by various acts of Parliament from 1766 to 1831. In 1846 the directors of the Trent and Mersey Canal, who were all local men, thought they were being left behind by the construction of railways all over the country, and that the time had come when they must have a railway to serve North Staffordshire. They therefore obtained three acts of Parliament for building railways. By these acts the canal was merged in the railway company; so that, in point of fact, it is rather a railway belonging to the canal than a canal belonging to the railway. Under the act three of the nine directors are obliged to be canal directors. Before the construction of the railway the tolls were very heavy; they were 2d. per ton per mile on everything. In those days there were no roads; everything to and from the potteries was carried on pack horses; so that the canal was an enormous advantage to the district then, and they could charge practically whatever they liked. These tolls have been cut down by various acts of Parliament. The act authorizing the North Staffordshire Railway cut them down one-half. They were then cut down again in 1865 and 1868, and again in 1892; and are now on the standard level of tolls authorized by the board of trade in 1892.

The present capital of the canal is represented by £1,170,000, 5 per cent perpetual preference stock, the value put upon the canal at the time it was merged in the railway, and £311,400 spent on it since that date by the railway company in carrying out various improvements, making a total of £1,481,400, or about £12,500 per mile of canal. That is cheap, looking to the district through which the canal passes and

to the considerable number of tunnels which had to be constructed. The low cost came first from the fact that the landowners largely gave the land, or at a nominal price, and the cost of labor and materials was enormously less one hundred and fifty years ago than now. It has been the practice on the canal to make improvements out of revenue ever since the beginning, and during the last twenty years over 1,100,000 cubic yards of earth have been dredged up and the width and depth of the canal between the potteries and Runcorn have been so much increased that the barges can now carry 28 tons as against 21 tons twenty years ago. In 1891 we obtained an act of Parliament and in the following year carried out the work of duplicating the locks at the north end of Harecastle tunnel. The number of barges that pass through that summit lock at Harecastle is from 170 to 180 a day. In 1904 we obtained an act for enlarging the Rudyard reservoir. That is the summit reservoir from which all our water, or the principal part of our water, is supplied. We have at times had serious difficulty from lack of water in dry times. I anticipate that the construction of this reservoir will obviate that difficulty.

The Trent and Mersey Canal extends considerably beyond the North Staffordshire Railway at each end, and therefore there is always a kind of prejudice in favor of the canal as against the railway for through traffic. The company favors putting the distant traffic on the canal. I do not think there is any competition between the railway and the canal excepting that. A very large number of the pot works are on the canal alone, and by no process could the railway carry the materials they use so cheaply as they get it by canal.

We join the River Trent at Derwent Mouth, and the navigation from there on belongs to the Trent Navigation Company. That connects our canal with Hull by way of Gainsborough, Newark, and Nottingham. We also connect by the canal itself to Burton, the potteries, and on the other side of Northwich, Runcorn, and Chester, at the west end; and across the Mersey to Liverpool and Birkenhead.

From the junction with the Trent at Derwent Mouth to Burton, 16 miles, the locks are 78 feet long, 14½ feet wide, and the canal has a minimum depth of 3 feet 9 inches.

We used to have considerable traffic from the iron-making districts in the potteries to Hull for export to Germany and the Continent, but owing to the competition of the Midland Railway and the bad state of the Trent Navigation, that has practically died out. The Trent Navigation Company have made numerous attempts to improve the navigation of that river, but with very indifferent success; they have always had difficulty in getting money. There is a bill in Parliament this session for raising more money for that purpose. The bill is promoted by the Trent Navigation Company. It has been arranged that the North Staffordshire Company shall strengthen the board of the Trent Navigation by the appointment of two directors holding the necessary qualification in Trent Navigation shares. That will not bring the Trent Navigation under control of our railway in any way. What we are hoping to do is to screw up the Trent Navigation Company to do a little more than they have been doing, and possibly to strengthen their financial position.

We hope to improve the navigation from the potteries to the east coast, and also from Burton to the east coast. From the potteries to

Derwent Mouth would be, on our canal, about 55 miles; and then there would be about 50 miles on the Trent Navigation.

At the Mersey end of the canal, on the 6 miles belonging to the Bridgewater Canal, the locks are 72 feet long, 15 feet wide, and the depth of water is 6 feet, and the adjoining length of the Trent and Mersey Canal from Preston Brook to Middlewich, a distance of 16 miles, there is only one lock, which is 76 feet 3 inches long, 14 feet 9 inches wide, and the minimum depth of water is 4 feet 3 inches. This enlargement was carried out in 1891 at a cost of £22,000: and barges, conveying 60 tons, can now travel up as far as Middlewich conveniently, from the Mersey. Between Burton and Rugeley, a distance of 20 miles, the locks are 73 feet long, 7 feet 6 inches wide, and the minimum depth of water 4 feet. Then from Rugeley to Middlewich, 43 miles, the locks are of the same size, but the minimum depth of water is 4 feet 6 inches. I have now given all the locks on our canal.

The Trent and Mersey Canal would be an essential part in any through canal scheme. The cost of increasing the size of the locks in the narrow part of our canal would be very great: and the Hardcastle tunnels I look upon as being incapable of increased size; a diversion would have to be made, either by a lift, or in some other way, at very great expense. If a new canal were made instead of utilizing ours, I think Mr. Saner has named the best location from an engineering point of view; but, like most engineers, he overlooks the fact that unless a canal carries traffic it is not of much use. A canal should pass right through populous towns, so that the works would have the benefit of being absolutely on the canal. It is the cost of carting to the canal that kills it. A very large proportion of the principal potteries are right on the canal. Where they are not on the canal, they use it to a limited extent for their raw materials.

The canal carrier is usually a different person from the canal owner; subject to paying his toll to the canal company, he does exactly what he likes; he goes where he likes, does what he likes, charges the public what he likes, and makes as much money as he can. He is under no restriction of any kind. The carriers on our canal are mostly substantial companies; Fellows, Morton & Co. and the Anderton Company are large carriers on our canal. Then there are a lot of big firms on the canal who have boats of their own; and they simply pay the toll and take their stuff about as they like. We were carriers ourselves at one time, but we found we could not make it pay, because these other people carried too cheaply for us, and therefore I think there is not much to complain of as to rates. These carriers are at all points in competition with the railway. Of course the canal does not carry as much as before there was a railway, but of recent years there has been a distinct improvement in the weight of traffic on the canal and in the receipts. The average distance of traffic on the canal is a little over 20 miles. We are under a considerable pecuniary liability to pay the interest upon the capital in the canal; and we have done everything we possibly could to make the canal a success; and I believe our canal is in better order than any in Great Britain. I have very reluctantly arrived at the conclusion that a narrow canal, like the larger part of ours, is not capable of carrying heavy traffic profitably; they can not carry the quantity of traffic to compete with the railways.

Our canal passes through rural districts for a large part of its length. I have never known a farmer to have an odd lot of traffic by the canal or send off an odd lot of traffic by the canal, although it may run right through his farm. In a district like the Potteries canals are a most undoubted advantage; they go alongside a great many works that have no railway communication, which enables them to get their raw material at a rate which, including cartage, would be absolutely impossible for a railway to afford. We find them useful in bringing the raw material, which afterwards as manufactured goods goes away by the railway. For distances which can be covered in one day by a horse I think a horse is the most economical method of traction, say, for 20 or 25 miles. For longer distances I think some form of mechanical traction is necessary.

RAIL AND WATER COMPETITION.

If you are going to put the canal-carrying companies up to compete with the railways, I think they would want a subsidy; they would have to carry so much traffic at a loss that it would run away with all the profit on the other traffic. I am speaking of narrow canals only. Except for short distances, I do not think it possible for narrow canals to compete effectively with railways. For through traffic you must have larger canals. I should be almost disposed to say that instead of providing large canals to compete with railways you had better spend your money in buying up the railways.

A canal from port to port could not compete with the sea route. The traffic to be gotten is from a port inland; not from port to port.

I think the board of trade should appoint some competent engineer, who would see to what extent the small coasting vessels could be brought up inland, either by means of improving the rivers or by means of improving the canals, so that without breaking bulk you could get your coasting vessel up into the center of the country. After you have gotten up a certain distance, then the narrow canal would be a matter of convenience, no doubt, for distributing your produce to the works and collieries, etc, where it is wanted—a canal that would carry 60-ton boats at any rate. A 60-ton boat is not fit for seagoing, but it is quite fit to go into the estuaries of the rivers.

If vessels of 200 to 250 tons could come right up to the potteries with the china clay which comes from Cornwall, and could load back with coal wanted in Cornwall, the freight would be very cheap. I would bring a deep waterway right up to the potteries if practicable, but I fear the expense would be prohibitive. It might with advantage be brought up as far as Middlewich, I should say, to the foot of the locks in that town. Above that I would construct a canal to take boats of at least 60 tons, with locks 68 to 70 feet long, 14 or 15 feet wide, and drawing 5 feet 6 inches of water. My idea would be to connect the potteries with the river Mersey. I would like to see the scheme carried out of treating this as part of a through route to connect with Birmingham, by bringing a wide canal as far as Haywood Junction, but I fear the expense would be against it.

SCHEME FOR IMPROVEMENT OF ENGLISH CANALS.

I think a survey should be made of the coast line and the existing waterways, whether natural or artificial, showing in what way they could be made available for small seagoing vessels, or, at any rate, for wide barges, up to the principal manufacturing districts. When you get beyond that you get such a very big thing that I am afraid the cost would kill it. My great object would be to connect populous and manufacturing places with the nearest port. I do not attach any importance to communications right across the country.

I quite agree with Mr. Lee that a considerable number of canals are not worth spending any money on. I regard canals of no value to agricultural districts. In regard to Mr. Lee's statement that railway companies lose money on the coal traffic to London, I think he is rather prejudiced against railways. The net receipts from the coal traffic may not be very large, but they all go in the reduction of standing expenses, which would be going on just the same whether there are half a dozen coal trains running over the same line of rails as the other traffic. I would say there is a profit on that coal traffic, though not a very large one; it depends very much on the length of the run.

COST OF HAULING.

I have taken the cost of hauling 400 tons of coal daily from a colliery in North Staffordshire to London, a distance of, say, 150 miles, and it works out as follows: The rail equipment required would be 160 10-ton wagons at £75 each, £12,000; two locomotives at £2,250 each, £4,500; total rail equipment, £16,500. Men required, two engine drivers, two firemen, two cleaners, two guards; eight men in all. The canal equipment would be 224 25-ton canal boats at £150 each, £33,600; 224 horses at £15 each, £3,360; total canal equipment, £36,960. Men required, 224 boatmen, 224 horse drivers; a total of 448 men. If instead of horses steam tugs are used, each tug carrying 25 tons of coal and towing three barges, the equipment required is 168 15-ton canal boats at £150 each, £25,200; 56 tugs at £1,000 each, £56,000; total canal equipment, £81,200. The men required would be 168 boatmen and 112 tug men; total, 280 men. The way I have arrived at the amount of equipment is that I have considered that of the 160 wagons there are 40 standing at the colliery loaded, 40 in London unloading, and 10 in each direction, going up loaded and down empty. In respect of the boats, there are 16 25-ton boats at the colliery end loading, the same number in London unloading, and as the journey will take six days, there will be six lots of 16 boats going up and as many coming down empty, always in transit. This is horse traffic. Assuming that both the rail and the canal have been acquired by the nation and are toll free, and that the repairs and renewals of the boats are about the same as of the wagons, in the three hundred and seven working days of the year the locomotive engines will have run 92,400 miles, which, at the usual computation of 1s. 1d. per train mile, represents £5,000 in round figures. In the same number of working days each boat will have traveled 7,675 miles, which, multiplied by 224, comes to 1,719,200 miles, costing at the usual computation of 10d. per mile loaded and 5d. per mile empty, roundly, £53,000, as against £5,000.

If instead of horses you use tugs. I estimate that each tug would have cost, to work and repair for the year, £400; so there are 56 tugs at £400, £22,400; 168 boatmen at 30s. a week each, including lodgings, £13,000; a total of £35,000, in round figures. Although the tugs will travel faster than the horses between the locks, owing to the delays in getting the train of boats through the locks, the time occupied on the entire journey will be about the same. It will take forty-five to fifty minutes to get a tug and train of three boats through a lock of the present dimensions. Of course with a broad canal the figures would be very materially altered. I reckon on the basis that it costs a little bit less than 1s. 4d. a ton a mile to carry, irrespective of tolls. This is simply the cost of lugging the stuff along either the waterway or the railway. That is the operating expense. Ten pence per mile is what we actually pay the men for pulling the boat along, loaded, and 5d., empty. I am considering both the railway and the canal as toll free—that they have been acquired by the country—and it is simply a question which can be worked the cheapest.

We carry a large coal traffic for short distances on our canal.

The average haul on our canal is about 20 miles, and on our railway 15.

For distances beyond 20 or 25 miles I have no doubt rail transportation is the cheapest. For lesser distances it depends on facilities for taking up and delivering. Say you have to cart down to the canal wharf, or from it, and do not to or from the railway station; that would give the canal the advantage. I am speaking of narrow canals.

I think it possible that the cost of carriage is greater on the Erie Canal in New York than on the railway. In America they haul 100 tons on a railway 1 mile for 1d. We have never got up to that in England, because we have not the same gigantic engines or so large trucks. That is what we are looking forward to.

I have never recommended to our board enlarging our canal so as to take 250-ton vessels up to Middlewich, and reconstructing the smaller canal farther up. Looking to the poor returns on the money they have spent on the canal, I think it would be a waste of eloquence to present the project to them. The object of reconstructing the canal would be a special one, to get small vessels with china clay up to Middlewich. Beyond that I should be exceedingly unwilling to disturb the people who have wharves on the canal. That is the reason for maintaining it as a canal rather than altering it into a railway, because the custom of trade has grown up in that way.

### EARNINGS OF THE TRENT AND MERSEY CANAL.

The earnings on the canal are not nearly sufficient to pay the 5 per cent on the £1,170,000.

We used to have a very substantial traffic from the potteries to Hull. The improvement of the Trent would enable us to recover some of it; but the continental traffic in earthenware from the potteries has been almost killed by the German import duties. We have experience of canals being of great benefit when they connect collieries with manufactories.

ENLARGEMENT OF ENGLISH CANALS.

Barges to carry goods from the manufactories inland directly to the ship's side at Liverpool would have to be at least 15 feet wide to be safe in the tideway. To enlarge the canals to take vessels of that width would be very costly work, because in the populous places the works have closed up onto the canals, and it would involve the purchase of expensive property. If there is a break of bulk and you have to transship, the advantage of water transportation fades out to nothing.

There are three classes of traffic on our canal: There is the coal and limestone in the lowest class, the clay and other pottery materials in an intermediate class, and then a very large weight of manufactured earthenware, which is quite of the highest class, going to Liverpool for shipment abroad. I imagine that last class is given to the canal instead of the railway because it is cheaper. The factories have been built on the banks of the canal instead of near the railway: and if their stuff goes by rail, it has to be carted to the station. The modern factories have not located near either the canal or railway: they have isolated themselves in a curious way.

The carriers probably agree as to the rates they will charge over our canals, being wise men, but I have no knowledge of it officially. To a certain limited extent our company agrees with the carriers, so they will make rates which would unduly depress our railway rates; but, speaking generally, our company is quite content that they should go either by railway or canal, and we do not trouble ourselves. The list of rates used to be drawn up in conjunction with the North Staffordshire Company when we were carriers on the canal. Since then we have dropped out of knowledge on the subject. We do know that in respect of rates from Liverpool they are agreed between the Liverpool carriers and the Northwestern Company, and it is a recognized institution that the canal rate shall be a percentage lower than the railway rate to compensate for the extra time they are on the road.

RAILWAY AND CANAL COMPETITION.

Q. I think one may reasonably conclude that there is no effective competition in rates, and that you do really understand one another as to the tonnage you shall carry?—A. I think you may take it that nowadays there is no competition in rates between anybody or anything; prices are agreed and everything is agreed. Wherever there is a prosperous community, there is a ring which keeps up rates, prices, and everything else.

Q. That is really what I was trying to get out: so that there is really no effective competition, and for all practical purposes the rates over the canal charged by the carriers are also the rates which would satisfy the wishes of the railway company—that is to say, for all practical purposes the rates are one?—A. Very nearly. I will tell you quite frankly what we do. Whenever we get an application from the Northwestern Company or any other company for a rate, say, between Liverpool and Derby, we always write to the canal carriers who are carrying between these points and say, "Such and such a rate is proposed; how will it suit you?" If they say, "Too low," we stick out and try to get the railway rate put up a little bit;

but if they say, "All right," we agree. To that extent the rates are agreed. We keep our canal carriers fully advised of whatever is going on.

In some instances motors over highways compete with railways, as in moving heavy boilers, which would be very inconvenient and costly to carry by rail, and in transporting corrosive acids, which railways are not fond of. I have no doubt they could carry almost any commodity for distances up to 20 miles at greater advantage as against a railway. It might be that, so far as many commodities are concerned, money spent on improving the roads would produce better results for the country than on canals.

Theoretically one carrier on a canal could do the carrying cheaper than many, but you would do away with the competition, which is now keen.

## THE RIVER SEVERN (ENGLAND).

Mr. THOMAS SOUTHALL. I am clerk to the Severn commissioners, and have been since 1861.

The river is about 210 miles in length. The part of it under control of the Severn commissioners extends a distance of 43 miles, to a point 1 mile above Stourport.

In 1790 an act was passed to enable the Staffordshire and Worcestershire Canal Company to improve the navigation of the river from Stourport to Diglis. They constructed jetties, which were declared a nuisance and ordered removed. The navigation continued in a very unsatisfactory state until 1835, when there was a general movement for the improvement of the navigation. Engineers were called in who presented a report on a means of getting a depth of 4 feet 6 inches of water. In 1837, 1838, and 1841 bills were brought in to form a joint-stock company for making improvements, but Parliament would not hand over so important a navigation to a joint-stock company. Steps were then taken to get the improvements carried out by a body of commissioners, selected from a number of public bodies connected with the Severn and the canals. Thus the Severn navigation act of 1842 was passed, by which extensive powers were given to the commissioners to dredge and deepen the river and to purchase land for locks and weirs. They were empowered to borrow £150,000. There was great opposition to the construction of the weirs, for fear they would cause floods and spoil the land; but they have not produced such results.

The Staffordshire and Worcestershire Canal Company were much interested in the Severn improvement, as it was their outlet to the sea. They obtained powers to lend or guarantee the first £150,000, and £30,000 more, and subsequently further powers to lend money to the commissioners or guarantee the payment of money loaned them. The commission borrowed in all £300,000, which they expended in the purchase of land, the construction of locks and weirs, dredging and other expenses connected with the improvements, and in the payment of the cost of these acts. The whole of the mortgages became vested in the Staffordshire and Worcestershire Canal Company, or guaranteed by them, under all the acts except the last act of 1890. They are the sole mortgagees as to these earlier mortgages, of which £65,000 remain due. None under the act of 1890 has been paid off, nor much interest thereon.

The Severn navigation act was passed in 1842, and in 1845 an application was made to Parliament for powers to construct a railway from Oxford to Worcester and Wolverhampton. A great part of that railway, the northern end of it, ran pretty nearly parallel with the river Severn and the Staffordshire and Worcestershire Canal, and Parliament put the railway company under terms by their act of Parliament to guarantee to make up the tolls of the Severn commission to £14,000 a year. That guaranty was suspended by a subsequent act, but it was brought into force after a few years, and the Great Western Railway Company for many years paid to the Severn commissioners £6,000 or £7,000 a year. That was an instance of a navigation profiting by a railway company instead of the other way. The effect of the completion of the railway was to reduce the tolls that had begun to be payable on the Severn commission. The railway paid to the commission sums varying, annually, from £5,288 to £6,928, up to 1890, when another agreement was made, under which the railway company paid the sum of £100,000 and gave up some mortgages from the commissioners which they had become entitled to, in consideration whereof they were discharged from their liability under their guaranty.

The Great Western Railway Company was authorized to have three Severn commissioners as long as any money remained due to them. The number of commissioners was originally 30, but it has varied from time to time.

By the Liverpool corporation waterworks act of 1880, the corporation of Liverpool got powers to take the water of three rivers which are tributary to the Severn and were compelled to give the Severn compensation water.

The commissioners now number 35. They are unpaid, and are required to pay their own expenses in attending meetings.

The tolls authorized by the act of 1842 are decidedly moderate. From Gloucester to Worcester they were ¼d. per ton per mile, but not exceeding 6d. for the whole distance of 29 miles; and from Worcester to Stourport ½d. per ton per mile, but not exceeding 6d. per ton for the whole distance of 13 miles. By the new scale of tolls made under the provisions of the railway and canal traffic act of 1888 they are now 0.25d. on the lower part, and 0.40d. on the upper part per ton per mile. These tolls have been somewhat further reduced under some agreements for through traffic, in some cases.

Between 1847 and 1857 the amount of tolls received varied from £11,835 to £9,414. Between 1857 and 1891 they varied from £9,304 to £7,071. Between 1891 and 1898 they varied from £7,842 to £7,251. Between 1898 and 1905 they varied from £6,648 to £6,069. The commissions have derived very little income except from tolls. The receipts for last year were: Tolls, £6,648; from other sources, £324. Expenditures were: Dredging and maintenance of works, £2,328; salaries and wages, £1,686; interest on mortgages, £1,800; contribution toward deficiency in revenue of Thames and Severn Canal, £148; rents, rates, insurance, printing, stationery, and parliamentary expenses, income-tax and miscellaneous expenses, £636. Total expenditure, £6,598. That is about a fair average of receipts and expenditures for several years past. By the Severn navigation act of 1890 the tolls received by the commissioners in excess of £8,245 (the average for three years previous) was made the only fund for payment of

interest on the £30,000 borrowed under that act. A great increase of tolls was expected from the improvements to be made under that act, and our mortgagees were willing to lend us the money on that condition. The income for several years has not been sufficient to pay the interest. There is an arrear of interest both on that mortgage and on the mortgages made under the acts of 1842 and 1844. The total arrears are £30,324; but the principal money is reduced below £100,000.

There was strong support to the act of 1890 from the corporation of Cardiff and the large timber merchants and other traders carrying on business at Cardiff. They held out expectations that they would put a large quantity of traffic on the river. They did not do so; it is currently believed that they obtained their advantage by getting diminution in railway rates. But their failure is also attributed to another cause—the Westgate Bridge at Gloucester, an arched bridge with a headway of but 18 feet at the center at low summer level. That is a very great obstruction. There is a railway bridge at Sharpness the piers of which have proved dangerous, several vessels having been wrecked there. Consequently the traffic goes by the Gloucester and Berkley Canal almost exclusively. There are many bridges, only four of which have opening spans. We are told that until the fixed bridges are converted into opening bridges or means found of passing them by the construction of a new channel there can be no extensive development of traffic.

Formerly the traffic was hauled by men; then horse towing paths were made, and now the greater part is worked by tugs. It is not uncommon to see 10 or 12 vessels behind a tug. I believe one has been known to bring up as many as 26 canal boats and barges and trows. A trow is a boat peculiar to the Severn, carrying 70 or 80 tons.

Forty or fifty years ago a steamer traded from Worcester to Bordeaux on the river, but the Westgate Bridge and other difficulties discouraged them. After the improvements under the act of 1890 were made a company put on two steamers, but the venture was not successful.

Goods on the Severn are chiefly carried by vessels of 70 or 80 tons capacity, or even up to 100 or 120 tons, but mostly in canal boats from 30 to 35 tons in size; limited to that size because they have to pass through the locks on the small canals. The navigation is in very good condition—7 feet from Stourport to Worcester and 10 feet from Worcester to Gloucester—and it is very seldom interrupted. This increase from 4 feet of water has been obtained by the expenditure of £300,000, of which more than £200,000 has been repaid. That money has not been provided by parliamentary grants, but by loans from the public.

The great need for the further development of the traffic is the improvement of the bridges.

A project has been suggested for a waterway sufficient for seagoing vessels of 300 tons from the river Severn to Birmingham. I should be very glad to see it carried out. It would entail heavy expense. My impression is that the improved navigation should go up the river some miles farther than it does, and that the improved channel should not go direct to Birmingham, but through Dudley and the Black Country, where land is not quite so high, and it might

be carried on to the Trent. The outlay would be large, but not unreasonable. I am inclined to think there would be a reasonable return on the expenditure. The improvement of the Severn from Gloucester to Stourport could be carried out at moderate expense. A proposal was made to contribute toward the cost of trying to get an act of Parliament to remove Westgate Bridge, but the commissioners wanted something in the shape of a guaranty that there would be traffic brought that would pay the interest on the money.

Complaints are made by boat owners of having to pay tolls on three or four different navigations: that is a great nuisance. Fifty miles would in many cases extend over three or four navigations. Sometimes money given to the boatman disappears and is not used to pay tolls; and the nuisance of having to make declarations as to cargo three or four times on a little journey is discouraging. It would be a great advantage if the whole of the navigations were vested in one body. I should desire it to be a public body. I do not think there is any probability of several millions of money being found for investment on the mere expectation of an increase of tolls. The money would have to be government money or county money; public funds in some way. The county councils interested would be Gloucestershire and Worcestershire; and if the scheme were carried out toward Birmingham, there would be Staffordshire and Warwickshire also; but I do not think you would get four of these public bodies to agree to it. I think one ownership would be best in the end.

I think in a scheme for general improvement main lines should be first considered, and then you could deal with subordinate lines from time to time as the necessity and advantage appears. The river Severn necessarily would form an important link. I think one authority for the whole country would be better, because wherever two different districts met there might be different rates and different tolls, causing difficulty. That would do away with all idea of competition between parts of a navigation. There would still be the competition between railways and canals and competition between carriers on canals.

## BELGIAN CANALS.

Sir Cecil Hertslet. I am consul-general for Belgium, located at Antwerp. Belgium is one of the most important commercial and industrial countries in the world considering her diminutive size. In regard to exports, the manufactures of Belgium are principally forwarded to Antwerp; and as regards imports, nearly all the raw material, manufactured products, and other goods come in by way of Antwerp, which is a large distributing center for a great part of the Continent.

One of the principal means of transport in Belgium is the well-developed canal system of the country. Belgium has an area of 11,373 square miles. In 1905 the length of the railway used for heavy traffic was 2,821, and of light railways 1,531, making a total of 4,352 miles. These railways are almost entirely owned by the Belgian state, and particularly favorable rates of freight are offered upon them. The light railways are of smaller gauge; they run by the side of the roads as a rule, connecting the big towns with the smaller. They are more like steam tramways than railways. They

carry goods, but not heavy goods, to the same extent as the canals or main railways.

The length of the canals and navigable waterways in Belgium in 1904 was 1,349 miles. Over 85 per cent are the property of the state, and therefore can not be said to be exploited in direct opposition to the railways, although there is some competition. The actual waterways are owned by the state, and tolls are levied upon them for their partial upkeep upon the barges using them. The barges are, however, the property of private individuals or companies, the rates of freight charged being, of course, subject to competition at the hands of the various barge owners.

In Belgium the canal system is very largely developed and the waterways are used to a great extent in conveying raw materials and cereals to the towns and all kinds of merchandise from the place of manufacture to the ports where they are shipped on ocean steamers. This shipping of goods by barges is carried out from the factory to the ship's side without change. Take a consignment of 300 tons of steel rails manufactured at Liege to be forwarded to Antwerp for export. A comparison in the rates of freight by railway and canal will show the advantage to be with the canal, the rates for the 300 tons being about £79 by rail and £39 by water. The average freight charges in Belgium are much larger by rail than by water. There are rare cases, however, in which canal rates are equal or higher than railway rates on account of extraordinary cost of navigation.

The railway rates for coal and minerals in Belgium are particularly low.

There is, of course, competition of a certain kind between the two modes of transport, and the canals undoubtedly take from the railways a certain part of the profits which the latter would gain by carrying a larger quantity of merchandise, but then the railways are state owned and the desire to show a good balance sheet is tempered by the influence of the minister of public works at Brussels. The Belgian Government realizes that a greater gain accrues to the country as a whole by a cheap means of conveyance in the shape of canals, rather than by the reaping of a larger profit by the railway system. Railway rates are generally very low, but these low rates are offered primarily for the good of the country as a whole, and they do not intentionally operate to the detriment of the canals. The Government makes up out of public funds the loss incurred on the working of the latter. There are different rates of freight on the waterways. Goods of a perishable nature are always charged a higher rate, as liability is accepted by the barge owner until they are delivered on board ship or on the quay. In winter charges are higher than in summer as the barges are only able to be worked during the daytime, stopping as soon as night falls.

The railways are entirely a government concern and the railway rates are fixed by the Government, whereas the canal freights are subject to fluctuation through competition; but the canal rates are always cheaper for long distances. Canal freights to various places in Belgium are quoted daily at Antwerp on the exchange, and naturally fluctuate in accordance with the amount of merchandise available for carriage. Many causes combine toward raising or lowering current rates and there is, of course, keen competition between the

numerous barge owners. In most cases the rates offered by one barge owner differ but little from those offered by another.

There is considerable competition between Antwerp and Rotterdam for traffic up the Rhine. The difference between the rate per ton for grain from Antwerp and Rotterdam to places on the Rhine in large shipments is about 4½d. per ton on account of the additional distance to be traveled from Antwerp and difficult navigation from Antwerp to the Rhine. Nevertheless Antwerp secures a considerable proportion of the trade on account of her facilities in dealing with cargoes and other conveniences.

The canals of Belgium are so arranged as to be a benefit to the whole commercial population and not of particular advantage to one or more industries. The endeavor is to have every section of the manufacturing districts in direct touch with the large towns of Belgium, with the seaboard, and with the manufacturing centers of other neighboring countries for the interchange of commodities and other manufactured goods. I should also add the coal districts. The canals that are in touch with the agricultural districts are of lesser importance; the main improvements have been done with a view to the manufacturing and coal industries. The agricultural products handled are largely grain imported to Antwerp.

The Government, in addition to bearing the expense of constructing the canals, subsidizes them very considerably. The figures for 1902 show that the total receipts from dues levied on barges using the canals amounted to £69,146, while the expenses during the same year for the upkeep of the canals, locks, etc., and payment of wages, etc., amounted to £187,266, the net amount which the state was called upon to defray over and above the receipts by tolls and dues being £118,120 sterling. The Government of Belgium, therefore, considers it good policy, notwithstanding its ownership of the railways, to involve itself in considerable expense in the upkeep of canals and waterways for the public advantage. The above figures do not, of course, include money voted for the construction of new canals. A loss is sustained by the Government in working the canals, but the benefit is gained by the whole commercial community through having a cheap means of transport.

A very important improvement in the Belgian canal system is now being executed; it is a canal to connect the eastern and western systems; the new canal being called the Central Canal. They have had more difficulty than usual with that canal, as that country is more hilly than the ordinary flat parts of Belgium.

The state contributes in varying degrees to inland harbors, the construction being carried out by the local municipalities, the amount of the government subsidy varying from one-third to one-half the total cost, and even more under some circumstances.

Municipalities on or near canals owned by the state give contributions to them, but they do not intervene in regard to the upkeep of the canals or other expenses, nor do they interfere in regard to navigation except where they have constructed quays or inland harbors. In that case they are empowered to levy tolls and dues on barges using the same, varying in amount and fixed by the Government. No contributions of any kind are given by the municipalities toward the construction of canals.

The city of Antwerp constructs bonded warehouses in that city, and private individuals construct others.

Provinces may or may not give a lump sum toward expenses of construction of inland quays and harbors in accordance with the increased importance such new works give to the province.

All canal improvement is done with the money of the Belgian state, with slight exceptions where concessions are made.

To the port of Doel, the last Belgian town on the left bank of the Scheldt, the state gave seven-tenths of the total cost of construction in view of the fact that the port was to be used as a quarantine station. The province in which Doel is situated gave one-tenth of the cost, the remaining one-fifth being borne by the village. In the case of Lillo, on the opposite bank of the river, the state paid one-half, the province in which the town is situated gave £1,000, and the remainder was paid by the municipality, which is entitled to levy dues approved by the state. Municipalities construct such work with the aid of contributions from the state, and frequently from the province. I conclude that municipalities do not levy dues to reimburse the amount expended in constructing harbors, but to bring in a fair rate of interest on the capital sunk in the enterprise, any surplus over and above such at the end of the three-years' period being devoted to lowering dues or carrying out new works.

The Government in power in Belgium is enabled to grant a concession to a private company for the ownership of a canal not exceeding 10 kilometers in length. For a greater length an act of Parliament is required. The tolls on canals are fixed by law, but the Government is empowered in certain instances to lower the tolls on a particular canal with a view of benefiting the industries of the district through which it passes. In many of the concession canals the state is a large shareholder. The Government fixes the rate of dues during the period of concession, but the parties receiving the concession may lower the tolls with the consent of the Government. They are not permitted to increase them.

The primary object at the time of making most of the principal canals in Belgium was to connect the various rivers in such a way as to utilize the natural waterways for as great a part of their length as possible, thereby decreasing the initial outlay on canal construction. Such rivers as were of insufficient depth, or deviated too far from the course designed, were canalized and made to meet the requirements of well-organized canal traffic.

The Scheldt and Meuse Junction Canal is one of the principal canals of Belgium. It joins the two chief rivers of that country, the Scheldt and the Meuse. It carries a great volume of traffic, and runs in almost a straight line from Antwerp to where it meets the Maestricht Canal, near the Dutch frontier. The object of that canal, in addition to furnishing direct means of communication with southern Holland, is to provide a short route to Liege, the industrial capital of Belgium, by which large quantities of manufactured produce are sent to Antwerp for export. The Canal de Jonction and Maestricht Canal together form the longest stretch of canal not dissected by rivers in Belgium, and it may be of interest to give the dimensions of the first section, from Antwerp to the junction, as a standard of the principal artificial waterways of Belgium: Length, 95 miles; width at water

level, 58½ feet; width at bed, 32½ feet; normal depth, 6 feet 11 inches. These are present dimensions; but improvements have already been begun which will eventually bring the dimensions of the waterway for the entire distance between Antwerp and the junction with the Liege-Bois le Duc Canal at Bocholt to the following: Width at water level, 105 feet; width at bed, 77 feet; normal depth, 8 feet 3 inches. The dimensions in depth from Bocholt to Liege will be the same, but the width will be rather less. On the completion of these improvements the canal will be navigable for barges of 1,000 tons capacity instead of 400 tons as at present.

I am not aware of any lock on the Meuse from Liege to the sea. They have not the hills to contend with that we have in England. On the Meuse and Scheldt Junction Canal there are 17 locks. Between Antwerp and Strasbourg via Liege there are 46 locks. There are 23 locks on the Meuse between Maestricht and Liege.

All the rivers are free of toll and some of the canals. The tolls are francs 0.0025 per kilometric ton. I have not worked it out to see whether that is approximately one-twelfth pence per English ton per English mile, as suggested by Mr. Rea.

On nearly all the large rivers, such as the Scheldt and Meuse, tugboats of considerable power are used, towing a long line of barges—from three to six or more. In certain cases petrol motor barges are use, and a service of these barges was recently started for working regular quick journeys locally to and from Antwerp. The cost of upkeep would probably be too large to permit of the use of such power by the large craft on the international canals, and there would be difficulty in maneuvering such barges without the aid of tugboats. There is only one tunnel on Belgium canals, but one is being built near Ypres. They have a system of elevators on the Central Canal. On the Meuse and Scheldt Junction Canal horses are used for traction, and sails as an auxiliary in case of fair wind Steam tugboats are not in general use on the canals of Belgium except from Antwerp to Liege, and on the Brussels-Rupel Canal. The distances to be covered in Belgium are not great, practically the longest journey within the boundaries of the country being that from Liege to Antwerp, 99½ miles.

An attempt was made some years ago at electric traction on the Brussels-Charleroi Canal by means of an electric tractor running on the towing path, but the experiment did not prove successful on account of the expense.

On the state canals the means of haulage are at the option of the bargeowners, except on the Brussels-Charleroi Canal, on which the bargeowners pay for haulage to the company which has the monopoly of the traction.

The standard size of locks on the principal canals is as follows: Liege to Antwerp, length 163 feet 8 inches, width 22 feet 9 inches; canalized Meuse, length 328 feet 2 inches, width 39 feet 9 inches; canals leading to France, length 127 feet 7 inches, width 16 feet 8 inches; Dutch canals for Rhine barges, length 390 feet 5 inches, width 52 feet 6 inches.

There are three ship canals in Belgium. One of them, from Ghent to Terneuzen, Holland, is partly in Dutch territory; another is from Bruges to Zeebrugge. These are of considerable size and used almost solely as a means of access to and from the sea for ocean-going ves-

sels of varying tonnage. The third is from Brussels to Rupel, and thence to the Scheldt and the sea, being used by small steamers engaged in local trade, and a regular service between Brussels and London.

The dimensions of the Ghent-Terneuzen Canal are as follows: Width of canal bed 78 feet 6 inches, width at water line 213 feet in Belgian section, 220 feet in Dutch section; depth of water 28 feet 9 inches. The canal is about 15 miles in length.

The Zeebrugge-Bruges Canal was constructed by a private company under the control of the Belgian Government. It is being exploited with the newly made port of Zeebrugge by the same company holding a long lease of the port from the state. The sea lock is 66 feet in width, and consists of two independent gates, with an intermediate chamber 174 yards in length. Each gate turning upon rollers, consists of a single leaf, serving for both flood and ebb tides. There are also two swing bridges for railway and other traffic. The length between the inside walls of the gate—bridges open—is 282 yards. The inlets and gate valves enable the chamber to be filled in ten minutes, and the chamber can be emptied by compressed air for inspection. The dimensions of the sea canal are: Width at bed, 73 feet; at water line, 230 feet; depth, 26½ feet. The canal is 6½ miles in length.

The Brussels-Rupel Canal is in course of being enlarged to accommodate vessels drawing 18 feet.

The canal to Louvain is sometimes spoken of as a ship canal, but it is rather a barge canal. It is available for schooners of light draft, up to 11 feet.

It must not be imagined that the sole idea of the Belgian canal system is to facilitate internal communication with the ports to and from which goods are imported and exported. Important canals connect Belgium with many European countries, and international transit and trade by means of canals forms a very considerable feature of the barge traffic of the country. This international traffic is largely carried on in the same barges without transshipment. Some of the Dutch and Belgian barges travel large distances into the Continent, both in France and Germany.

There is no monopoly for carriage on any of the canals of Belgium; any individual owning barges is allowed to run them on the entire system.

In the construction of sea harbors it has been the policy of the Belgian Government to give a grant or subsidy in aid of the work, and in certain cases to bear the cost of the work entirely, without the intervention of a local province or municipality. In the case of the new port of Zeebrugge and the inner maritime harbor of Bruges the construction and lease were ceded by the Belgian Government to a company formed with a capital of £360,000. The expenditures for the port at Zeebrugge, the canal to Bruges, and the inner harbor are as follows: Expenditure by the company, £291,818; Belgian Government grant, £1,550,022; subsidy from Province of West Flanders, £80,000; subsidy from town of Bruges, £154,065; total, £2,075,909. From this it appears that the Government is subsidizing the construction of the works by over two-thirds, and at the same time, although not actually carrying out the work, the Government has the scheme under its direct supervision.

The extension of the port of Antwerp has now been accepted in principle by the Belgian Government. The state will bear the entire cost of the construction of the improvements, which are estimated at about £7,500,000, irrespective of the military fortifications, and in addition will make over to the town of Antwerp the entire new dock system upon terms to be arranged.

Down to the beginning of 1900, during a period of twenty-five years, the state had expended on ports and canals £16,000,000.

The only hydraulic lifts on canals in Belgium are on the Canal du Centre. Of these one is in use and three in course of construction. I am told the one in use works well. It is known as "Clark's system."

A wooden canal barge with fittings, such as is used in Belgium to carry 300 tons, costs about £520. The annual permanent charges on such a barge are about as follows: Annuity of interest and abatement of capital sunk, £44; upkeep of barge and equipment, £20; license, £2; insurance, £10; skipper's salary, £48; cost of navigation without freight remuneration, £20; total, £144.

The total barge traffic at Antwerp in 1904 amounted to 36,077 barges, and 7,008,223 tons entered, and 35,778 barges, measuring 6,755,482 tons, cleared. That means about 100 barges leaving Antwerp every day in the year, including Sundays.

Belgium is the country in which inland navigation has been brought to the highest pitch of perfection. The lessons to be learned from her are the advantage of the central control of canals and the saving in expense of transport by a general use throughout Belgium of navigable waterways for carrying both raw materials from the ports to the industrial centers and finished articles from the manufacturing towns to the sea. Generally there is good traffic both ways. The commerce of Belgium as it now exists could not be carried on without the waterways. When canals are frozen and navigation is interrupted, the railways immediately become overcrowded and are quite unable to cope with the traffic. If such a condition were to become permanent, it would be necessary for the Government to double many of the existing railway lines and add greatly to the rolling stock. It is evident that Belgium owes her prosperity greatly to her waterways. It is much the same in Germany. A motive on the part of the Government in both cases is to save the great cost of increasing railway facilities, but the primary motive is to furnish cheap means of transport.

There is a very strong feeling in Belgium in favor of having all the canals toll free, and the chambers of commerce have recommended it; but the tolls still exist on most of the canals, though they are in no case high.

The waterways in Belgium have brought activity and prosperity into almost every corner of the country.

I consider the loss of £118,000 annually on the canals by the Belgian Government is an operating loss. I do not think any expense of construction enters into it. The government expense on construction is written off at once.

They are perpetually enlarging their canals and locks in Belgium. This does not interfere with traffic.

THE AIRE AND CALDER NAVIGATION, ENGLAND.

William Hammond Bartholomew. Am a member of the Institution of Civil Engineers; have designed and carried out all the works in connection with the improvement of the Aire and Calder Navigation for the last fifty years.

The total length of the Aire and Calder Navigation is about 85 miles; in addition to which the undertakers of the Aire and Calder Navigation are the joint owners with the Leeds and Liverpool Canal Company of the Bradford Canal, 2½ miles; also joint owners with the Sheffield and South Yorkshire Navigation of the New Junction Canal, 5¾ miles, connecting the South Yorkshire Navigation with the port of Goole, recently constructed at a cost of £290,000. That canal is 9 to 10 feet deep, with a top width of about 90 feet. There is a single lock upon it, 212 feet long, 22 feet wide.

The statutory name of the proprietors is still the "Undertakers of the Aire and Calder Navigation." The authorized capital was increased in 1901 to £2,500,000. The dividend in 1883 was 3⅜ per cent. This year it has been increased to 3¾ per cent.

The summit level of the Aire and Calder Navigation is 65 feet on the Leeds branch above the ordinary dock-water level at Goole, and the Wakefield summit is 50 feet above that level. In the former case the difference of level is overcome by nine locks and in the latter by six. A part of the tidal river Ouse, 10 miles in length, is under our jurisdiction. It joins the Trent, the confluence of the two forming the Humber. We spent £270,000 on that improvement. The river Aire is tidal for 16 miles from the mouth at Haddlesey. The navigation of the river Aire is superseded by our canal. The Aire formerly was the main line of the Aire and Calder.

There are three main routes between the east and west coasts: First, the Aire and Calder and Leeds and Liverpool; second, the Calder and Hebble Navigation, the Rochdale Canal, the Bridgewater Canal. Then there is the third route, which may be termed the "narrow-canal route;" that is, the Calder and Hebble Navigation, the Huddersfield Canal, the Ashton Canal, and the Bridgewater Canal. By the first route there are two authorities controlling the waterways; by the second, five; and by the third, six. There is much the larger traffic by the first route. The through traffic is small. Probably more of that goes by the Calder and Hebble route.

The locks on the main line of the Aire and Calder are 215 feet long by 22 feet wide, with 9 feet of water upon the sills. The waterway of the main lines varies; that upon the canals has a minimum cross-section area of 450 square feet and a surface-water width of 70 feet. The depth varies from 8 feet 6 inches to 10 feet. The headway under the lowest railway bridge is 12 feet 9 inches, navigable height. Vessels of 180 tons trade on the navigation. That is, on our own navigation. We are now making them on the lower length for about two-thirds of the distance from Goole, to connect with the coal field, 460 feet in length, 25 in width. We are also widening the canal throughout that length from 70 to 90 feet. That is to provide for larger vessels and long trains of compartment boats. We find that for getting the full advantage of steam power it is necessary to lengthen these locks and enlarge them. This is for about 28 miles of our lower

length. The alteration of the locks does not involve serious interruption to traffic; neither does the widening of the canal.

The Aire and Calder are carriers; and the by-trader—that is, the public boatman—is also a carrier on our canals. The by-trader carries a larger proportion than the company, especially of the grain traffic. I think it is a good system in every way to give the by-trader freedom; and if there is anything to be gained by the by-trader carrying the traffic, the public have the advantage of it. I think both ought to carry. If there should be amalgamation of the waterways under canal trusts, I should say that the trusts should not be carriers until it had been proved that the carrier failed in his duty. The trust should reserve powers to control rates as well as tolls, having regard to the cost of the working of the traffic.

On our canal the company carries the smaller and more valuable consignments, while the public boatman carries the lower class of goods. Each boat owner making an effort to get traffic, leads to a more complete canvassing for business. We have a carrying staff and adequately equipped carrying stations at the principal towns and delivery teams. We carry in flyboats carrying from 60 to 160 tons, and the steam tugs carry cargo up to 60 tons.

COMPARTMENT BOATS.

The mineral traffic is carried in compartment boats, each compartment carrying 40 tons. They are formed in a train, usually of 30, preceded by a tug. When they arrive at Goole they enter a hoist and are hoisted to the top of the shoot and then tipped over with their contents. That is done at a speed of 200 tons per hour. There is a great advantage in this system, which may be followed up in the future. There is great difficulty now in navigations getting to newly constructed collieries. Such are often more convenient to railways. To meet this difficulty, you place the compartments on a sort of trolley; they are drawn out of the water on an incline, and then the locomotive takes them up to the colliery on an ordinary-gauge railway, and they are loaded from the screens at the colliery and taken down again. This system might be adopted very generally for overcoming great difficulties of lockage or anything of that kind. This system, by going up to the colliery, saves one breakage of coal. The carrying compartments are 20 feet by 15 and 8 feet deep. We have had about twenty years' experience with this compartment system. Our competition with the railways is more acute than formerly.

As regards the cost of hauling by horse power, taking a horse and man at 10s. a day and the distance traveled at 18 miles, the cost would be 1s. 15d. per ton mile.

In the conveyance of minerals there is great economy in the compartment-boat system. Our average train has 30 compartments or 1,200 tons. To carry that in barges would take 12 barges of 100 tons each. These would require 36 men, 24 on the barges and 12 drivers; while a train of compartments is operated by four men; that is, the four tug men. By the use of improved tugs, carrying 50 to 60 tons of cargo, the cost has been much reduced. As matter of fact, our merchandise carrying trade haulage costs us nothing by steam power—in this way, the receipts for the cargo carried by the tug pay the whole working expenses of the tug, hence she tows all her boats without any cost.

We are in direct competition with the Lancashire and Yorkshire Railway, each carrying about 1,000,000 tons a year to Goole for shipment. We have kept up our quantity fairly abreast of them; our rate is a little below theirs, a rate satisfactory to the shipowners and fairly so to us, and I think the same to the railway; they are low rates. My experience is not favorable to electric traction, either by overhead wire or by electric locomotives. It is very costly and there is great difficulty in vessels passing and overtaking each other, even with two separate wires. A quick boat can not overtake a slow boat without a complete disturbance of the whole system. I inspected the Charleroi Canal, and I was surprised to find that if the motor was put into the boat on the wire and trolley system that brought the cost up to horse haulage, and that in the case of an electric-driven trolley on the towing path the cost was about one-half the first mentioned. Both systems have since been abandoned by that canal. I think in petrol or gas engines we are likely to find successful methods. Turbines have not been used as yet. A great difficulty with that is in reversing; in going into locks and avoiding collisions you must have good reversing power.

### HYDRAULIC LIFTS AND INCLINES.

They have a lift at Henrichenburg of very considerable size which lifts a vessel of 300 tons 50 feet, from one level to the other. I saw a steamer with 300 passengers on board lifted by it. The cost of the installation, including the hoist, was £125,000. Lifts for such traffic as I speak of could be constructed at much smaller cost. The cost of site is a large item. I am not in favor of lifts where you can avoid them. Frosts make difficulties with them; and there is great difficulty in getting an ordinary boatman to take due care in running his boat in; there is great damage done in that way in not stopping the boat in time, they will run into the gates, and very little will jamb the tank in its guides. Tank inclines are very good for ordinary vessels, but costly. Our system of incline works very well for the compartment-boat system; all you require is a simple railway incline with gradients of from 1 in 30 to 1 in 50. The locomotive hauls them on such an incline without difficulty.

### RAILWAY COMPANIES OPERATING VESSELS.

I wish to speak of the power of railway companies over steam vessels. This is a power which was granted, in the first instance, to railway companies for cross-channel passenger traffic, and now it has been extended to all classes of traffic. We have in the case of the Humber the Great Central from Grimsby; they have extensive steamboat powers for the home ports and also for the Baltic ports. They own the Grimsby docks, and they got those powers because they had pretty well shown that without these powers the docks could not fully develop. That remained in abeyance as affecting other railways and dock owners on the Humber, from the fact of the Humber agreement, which must have continued nearly thirty years; they had a division of traffic and rates and so on; so that no step was taken by other dock-owning companies and railway companies to employ steam vessels. That agreement has come to an end, and the result of it is that the

Northeastern Railway Company and the Lancashire and Yorkshire Railway Company have in the last two or three years obtained powers to run to various ports on the Continent. They bought up the general steam-vessel owners and secured their freights and, of course, secured their traffic. Then, when it comes to competition between water and rail, the steamers are the feeders of the general traffic, and so far as our own experience is concerned as yet in the case of the Lancashire and Yorkshire, I must say they have fairly worked the trade and given us facilities; where we can get the traffic consigned to us from the other side they hand it over to us. They also take our coal, as they promised to do very fairly, and I have no complaint to make against them about it; but they are becoming quite monopolists; they are buying up one set of steamers after the other until they have secured the whole traffic between the home ports—that is, the continent of Europe—and the Humber. These steamship powers were acquired by the Lancashire and Yorkshire Railway as regards the ports of Hull and Goole in 1904.

With regard to the port of Hull, the Northeastern bought up the local lines of steamers to the Continent, and now, in the present session of Parliament, the Hull and Barnsley are following in the same steps; so that the whole of the trade across to the Continent will be practically in the hands of the railway companies; and as to what the effect will be upon the water carrier in this country has yet to be seen. The monopoly is a very serious matter, and will be a great difficulty in the future for the water-borne traffic and against the public interest. A large quantity of traffic is handed to the railway companies' steamers at continental ports for conveyance to inland places in this country. Formerly, when that was unconsigned to any particular route, it was fairly divided between the water and the rail companies; but now all unconsigned traffic is claimed by the railway company, and it hands over only such traffic as is ordered by the bill of lading to be conveyed inland by water carriage.

In connection with the river Humber, there are 455 miles of inland waterways free of railway control, and 248 miles held by railway companies.

### HINDRANCES TO CANAL IMPROVEMENT.

The principal cause which has operated against the improvement of the waterways is one of finance. The failure of many such undertakings to pay adequate returns has caused the public to look unfavorably on such investments. Deficiency in water supplies is another cause. The bridges have been another source of difficulty. These have often been constructed with more reference to the cost to the railway company than to the interests of navigation. The break of gauge between one waterway and another has militated very seriously against amalgamations and also working arrangements, as well as remunerative rates. So far as the public is concerned I think the acquisition of the waterways by the railways has been a mistaken policy. Of course when that was done there were many cases in which the canal companies were so afraid of losing their all that they naturally snatched at what they could get, and those who were afield first managed to sell their undertakings much to the disadvantage of the remaining ones who were kept out.

Take the case of the Northeastern, which holds the river Derwent, 40 miles in length. The traffic on that river has practically ceased on account of the long stoppages. Whenever it was possible to find an excuse for repairing the navigation it was done, and the stoppages were extended to a month in time which we could do in three days, what we call a week-end stoppage, causing no serious delay. A sunken vessel, which we could raise in two days, is allowed to lie a month.

The London and Northwestern Railway runs parallel with the Huddersfield Canal. They stopped the canal altogether from September 4, 1892, to December 19; then from the 10th to the 20th of April, 1893. The Aire and Calder Company called the attention of the board of trade to this stoppage, and it was left in their hands. It was stopped from the 10th of June, 1893, to the 5th of September, 1894. Of course such stoppages make it quite impossible to run traffic over a railway owned canal with reliability, your business being ruined in consequence of the stoppages.

### AIDS TO CANAL IMPROVEMENT.

I think the waterways require a little aid from the legislature. They should have everything necessary to promote amalgamation without having to make costly applications to Parliament and so on. Having once come to terms, there should be some inquiry, some board of trade inquiry, or some less expensive and more expeditious mode of promoting amalgamation. The difficulties, for instance, which have prevented the Aire and Calder from amalgamating with the Calder and Hebble, or the Leeds and Liverpool, are largely in fixing a proper financial basis. Our navigation is up to date and progressive, while those named are not. The Leeds and Liverpool is kept in very good order, but it is inadequate to grapple with the competition of the present day. My own view is that the high altitudes which prevail in this country can be surmounted by carrying compartments over by railways, up and down again, so that all the cost of lockage would be removed.

In the second place I think the canal companies should have power to advance to each other capital to assist an adjoining navigation undertaking. At present we have no such power.

Third. Greater facilities should be given for the acquisition of land for widening waterways and restoring damage from mining. If we want to buy land, we have to go to Parliament to get power to do so. I think there might be some simplified machinery without going to that costly mode of obtaining land for that purpose.

Fourth. The height of bridges should be increased to give a clear headway of not less than 16 feet. That would admit the use of sea-going lighters in these lower-level canals.

Fifth. Some of the railways run parallel with the canals and between them and the collieries, shutting off access to the collieries. If a canal company wants to go across this embankment, it should not need an act of Parliament to do it, but some board of trade inquiry—some simple mode of dealing with it.

Sixth. When additional gathering ground for a reservoir is necessary it should be settled in some simple way without a bill.

Seventh. Where the alteration or enlargement of road bridges is needed the county or local authorities might assist largely. The surrounding country would be benefited by an improved waterway, and the canal authorities are large rate payers. As to the railway bridges, the legislature has acted unfairly to canals in allowing these bridges to be placed too low: and it is only fair that a government measure should replace the canals in a proper position in this respect, largely at the cost of the state.

Eighth. The principles of the light railway act, 1896, should apply, in some particulars, to new waterways or the altering of existing waterways. By that act there were powers given to the local authorities to undertake themselves to construct and work light railways and to advance money to them, and loans and special advances by the treasury were authorized. There are cases of canals where such powers would be of great advantage to the public.

Ninth. Canals should be empowered to supply water for power purposes, such water to be returned to the canal.

Tenth. We should have power to prevent the acquisition of public or private rights by the user of the towing path. The towing path is a private way, but is often regarded otherwise.

Eleventh. Railway companies should be prevented from disposing of or appropriating for railway purposes terminal or other traffic accommodations of canals held by them.

No fair comparison can be drawn between the waterways of Great Britain and Ireland and those of continental Europe and America in regard to trunk lines. The insular position of Great Britain and Ireland and the comparative proximity of the manufacturing centers and principal coal and ironstone fields to the tidal waters places these islands in a unique position. It is a well-known fact that conveyance by sea and tidal rivers is by far the cheapest mode of conveyance where large quantities of traffic have to be dealt with. Having regard to that fact, I am of opinion that the improvement of tidal rivers should have a foremost place. Tidal rivers should be considered as national waterways, and their improvement and maintenance should be undertaken by the state. The tidal rivers in the hands of conservances are very often mismanaged and unfairly managed.

On the Continent estuaries and rivers are practically managed either by the government or the states through which the rivers run.

I think the tidal and principal natural waterways should be developed in connection with each other. We should follow the continental plan, which is to carry traffic forward on the natural rivers or tideways, improving them as far as possible into the interior. In the case of the Humber, for instance, the state should improve the river as far as the tide flows; then the navigation that joins on should continue the improvement up to what I may call the central distributing point, that point being situated where the higher levels begin. I would take Birmingham as a center which you want to reach up the Humber with continental traffic or London traffic. I would improve the river in the manner I say up to Nottingham; I would make Nottingham the distributing center similar to Ruhrort on the Rhine, and I would work that traffic all by seagoing lighters carrying 400 to 500 tons. Nottingham would then be practically a seaport. The canal system from Nottingham up would be of a lesser gauge altogether, for dis-

tributing purposes. As to the seagoing lighters, that is not a mere suggestion; it is following up a practice now in force. They have now been going for ten years without a single loss through all the heavy storms they have contended with. They make the passages between the Humber and London with great regularity, carrying 300 to 500 tons. Their length is 112 to 140 feet, width 21 to 25 feet, and draft of 8 feet to 9 feet 6 inches when loaded. Their cost is £2,300 to £3,400. They might be employed between the corresponding inland ports of the Continent and the future inland ports of England. From the Tyne they have been running to the Rhine, Rotterdam, and other places. On the Continent they run a good deal from Hamburg to Antwerp, and the outer ports. Some foreign boats are now building, to come across to England, of this character.

You want to move traffic from London to Nottingham to be distributed in the Midland counties. These lighters would go alongside the ship in the docks or in the pool in London and take the traffic overside and save in a great measure the London charges. Then they come down the Thames round to the Humber right away to Nottingham. They run that at a very low rate indeed, worked with six men, one tug towing three lighters. No system has yet been devised that can do traffic so cheaply. It is an untaxed waterway.

I would use the inland harbors and the inner canals and waterways, not only for themselves distributing direct to customers, but also for feeding the railways, as the Birmingham canals feed the railway.

I think that up-to-date waterways, having ample supplies of water and modern equipment, would be of great advantage to the country. They would transport a very large increase of traffic at reduced maintenance and operating charges. From want of such improved waterways water-borne traffic in many cases has diminished, and such reduced traffic has necessarily been followed with discouraging financial results. I am of opinion that if the routes were judiciously selected and well-considered engineering arrangements made, after allowing time for the development of traffic, such improved waterways would prove remunerative investments and be of great public advantage. It would be advantageous if legislation should provide for the working of railway companies in conjunction with waterways for carrying traffic from inland distributing ports to such places as could not be readily served by waterways.

I am of opinion that the improvement of the tidal waterways should be undertaken at the cost of the state. With regard to inland waterways, each case should be very carefully considered on its merits. I think a very strong case should be made to justify the State taking charge of canals. In some cases where they were of great public utility and no private enterprise would take them up the state should, by trust or in some other way. I would not impose the duty of supporting such work on a district which did not desire it. Certainly the present disjointed system is a very unsatisfactory one.

I think it is practically hopeless to carry on remunerative canal traffic through agricultural areas; we do not find that the agricultural interests make that use of canals which one would suppose they would do. The farmers have not worked in cooperation and have not the money individually to pay for cargoes.

If the state takes charge of improvements of the tidal portions of rivers, I think it should also take steps to prevent those portions being injured by the treatment of the upper parts of the rivers.

On the Dortmund-Emms Canal they have some of their locks, turbines, and electric power obtained simply by the turbine, and that electric power so obtained works the gates and the sluices: but I do not think it is a paying thing. The state does that; but I think no British canal company could afford to do it. The engine houses are like drawing-rooms to go into; they are wonderfully fitted up.

Where the Aire and Calder competes with the railway the water rates are lower than the railway rates. On coal traffic there is about 2d. difference, which is considerable, from the West Riding collieries to Goole. In the merchandise traffic the difference is about 1d. in the shilling.

Great economies in transshipment, especially of grain, have been brought about of recent years by suction appliances. Transshipments which formerly cost 4d. to 7d. a ton is now done at 1½d. a ton.

Probably two-thirds of the traffic on our canal is coal. We also carry grain, timber, dyewoods, ores, and general merchandise.

### CANALS AS AN INVESTMENT.

I think there is quite an opening for well-considered schemes of improvement of canals, which would justify private individuals subscribing to find the capital. In many cases where the traffic is not in sight it can be developed. On the Aire and Calder we were thirty years in building it up to a dividend-paying basis. In certain districts where it is almost palpable they would pay, as in opening out mineral districts, I think individuals might reasonably be expected to find capital by loans on easy terms. In other cases where so good returns could not be expected and you fail to get the public to subscribe, the question comes in whether in the public interest the county councils or other authorities should assist. I am averse to the state taking it up until other resources are exhausted.

The Manchester Canal is a very peculiar case; of course it is a very bold undertaking, some say too bold; it does not pay, and may not pay for the next fifty years; but if it gets thoroughly developed, it will be an immense benefit to Manchester and the district. Of course the Manchester corporation took originally a very responsible position with regard to it. They got out of their responsibility fairly well by an arrangement which under the circumstances appears to be fair to both sides; otherwise the ordinary shareholders' position would be very seriously affected.

In regard to the storage of water for supplying canals, I think in this country we commenced in the wrong way. Watersheds ought to have been taken up by the different counties or authorities, who should have dealt with the whole question of storage, each watershed being under one control. That not having been done, there has been an immense waste of capital in making little reservoirs instead of making large, properly laid-out reservoirs dealing with the objects of the whole area of the watershed, and the consequence is that waterworks have cost a great deal more than they should have done.

I do not think that the States on the Continent, the United States and Canada, under conditions prevailing in those countries, have adopted a mistaken policy in developing waterways by the state.

GLOUCESTER AND BIRMINGHAM NAVIGATION COMPANY.

Mr. HUBERT WADDY. I am general manager and secretary of the Sharpness New Docks and Gloucester and Birmingham Navigation Company. The Gloucester and Berkeley Canal was constructed by the original company; the Worcester and Birmingham Canal was purchased by it in 1874; the Droitwich Canal is leased by it, and also the Droitwich Junction Canal. The Gloucester and Berkeley was incorporated in 1793. In 1905 the total capital was £1,272,372 on the whole undertaking; on the Gloucester and Berkeley it was £1,086,000. The canal was completed in 1827. The canal was carried 16 miles from Gloucester, 2 miles short of Berkeley Pill to Sharpness Point. At about its middle it crosses the Stroud Water Canal, and by that it is connected with the Thames and Severn Canal and the river Thames to London; and of course the other canals connecting with the Thames.

The idea of making the canal was to avoid the tortuous and narrow navigation of the Severn, making a route of 16 miles instead of 28½. It was originally constructed to take vessels of 600 to 700 tons. There are but three locks, two at Sharpness Point, and one into the river Severn. At Sharpness Point is a lock 163 feet by 38, and a barge lock 81 feet 6 inches by 19 feet 6 inches. The lock into the Severn is 142 feet by 21 feet 6 inches, with a minimum sill depth of 9½ feet. These locks are all used still, but only for barges and craft of that sort. At the new entrance, about three-eighths mile lower down the river than Sharpness Point, the entrance gates are 62 feet wide. The tidal basin is 540 feet in length by 300 in width. The lock is 320 feet by 62. The floating dock at Sharpness is 2,000 feet in length, with an average width of 320 feet. The floating dock is where the vessels discharge. The average width of the Gloucester and Berkeley Canal is about 90 feet, and the depth 18. It is level throughout. It is crossed by 16 hand swing bridges and 3 iron bridges. The width of the narrowest bridge is 35 feet 4 inches.

In 1827 the trade on the ship canal was 107,000 tons; in 1870 it was 567,600 tons; in 1905 it was 1,053,000 tons.

There were no dividends until 1845. Between 1867 and 1874 they varied between 3½ to 4½ per cent.

In 1870 the trade had so largely increased at Sharpness and the size of the vessels had so increased, that we found it impossible to carry on the trade and we went to Parliament for power to make the new entrance I have mentioned. By that time we had borrowed from the exchequer loan commissioners £76,434. The total capital expended on the old works had been £394,803. The docks were opened in 1874. The revenue increased very much and has gone on increasing. Nineteen hundred and five was the largest year we ever had; carrying 1,053,000 tons of cargo, with a revenue of £35,374. Although the amount of trade has nearly doubled, the revenue derived from it is not very much more. Our income in 1870 was £28,600.

The total expenditure on the Gloucester and Berkeley Canal section, up to 1871, was £488,949; and up to 1905, £1,086,827. The docks

and canal are kept in very good order. We have practically exhausted all our borrowing powers, including that authorized by the act of 1874, except that we have still power under the Sharpness docks act, 1879, to raise a further sum of £300,000. It is very doubtful whether we could raise any fresh capital for improvements; we would need a government guaranty to do it. There was a scheme for an extension of the canal and making a new entrance about 5 miles below the present one at Sharpness. The object was to enable very much larger vessels to come to the port, and also to give an increased time in which to work the tides. The estimate for that was £360,000. The depth of water at neap tides at Sharpness is 15 feet; the suggested new entrance would give us 23 feet. There was also a suggestion that the canal should be deepened and enlarged, which would cost something like £1,000,000.

The present canal suffices for all wants for through connection with the Midlands. The Worcester and Birmingham Canal, which our company also owns, forms a link in water connection between the sea and Birmingham, and also with other inland navigations. That canal can take only the ordinary midland canal boat, carrying about 35 tons.

The Droitwich Canal, leased by the Gloucester and Berkeley, does not even pay working expenses and repairs. The Droitwich Junction Canal is also a dead loss. The acquisition of these inland canals has been a very disastrous transaction to the Gloucester and Berkeley.

Goods can now be dispatched from Sharpness and discharged at Birmingham in thirty hours, a distance of 76 miles. On many occasions grain has been loaded at the same time on boats and railway trucks at Sharpness, and that by boat has reached Sharpness and been discharged before that by rail. With the improved towing service now contemplated it is anticipated that the water service will be generally quicker than the rail, owing to the absence of sidings, shunting, etc.

The principal reason why our company has not been able to carry out improvements on their inland canals has been that, owing to the loss on the Worcester and Birmingham Canal, we have been able to pay but small dividends on our ordinary stock, and that has prevented us from applying for further capital to our shareholders.

The volume of traffic on the Worcester and Birmingham Canal has diminished but very little since 1883, but the receipts have been reduced enormously. There has been very severe competition from the railways. Under the railway and canal traffic act, 1888, the tolls were reduced 50 per cent. I think it would be a remunerative undertaking to enlarge the gauge of the canal. I have my doubts, though, whether the trader would use the improved waterway. I know the general tendency is to get a rate from the railway and then come to the canal company. The other day we had a proposition to take up hundreds of thousands of tons of china clay; we reduced the toll to 1d. a ton, and I had a reply that there was little doubt we would get the whole of it. I did not hear from them for some time, and then learned they had come to an arrangement with the railway company. I am afraid the public would use the improved waterway mainly as a means of putting down the railway rates.

INFLUENCE OF CANALS ON RAILWAY RATES.

There is not a shadow of doubt that the working of the Worcester and Birmingham Canal by our company has led to very low railway rates. The rate on grain from Liverpool to Birmingham is 11s. 3d. per ton for 4-ton lots, as compared with 7s. 8d. per ton from Avonmouth, the distance being practically the same, and the 7s. 8d. rate includes delivery to waterside premises. It is calculated that the railway company have to pay 2s. for haulage in Birmingham. Taking the moderate quantity of 250,000 tons a year as the number of tons going from the Bristol Channel ports and other ports, this represents a saving of at least £40,000 a year to the Birmingham district, my company suffering a loss of £6,000 a year for the privilege of giving them that benefit.

I think canals and railways should work well together, to the benefit of each other and the public.

I consider that amalagamation of waterways is very desirable. All the canals from Birmingham south and going toward the Bristol Channel and the Birmingham Canal navigations, in my opinion, could be worked under one management to advantage, instead of short canals each having large staffs, boards of directors, etc.

I think, as far as the districts which have been affected by our taking the Worcester and Birmingham Canal are concerned, it would have been a far better policy if the canals had been obtained by forming a trust consisting of the corporations of Gloucester, Worcester, and Birmingham and the authorities of the Bristol docks and our own company. If that had been done in 1874, the money could have been borrowed at 3 per cent instead of 4 per cent, and the loss, if any, would have been shared by all the parties, instead of falling on my company.

STATE OWNERSHIP OF CANALS.

Mr. Edward Corbett, representing the Worcester Chamber of Commerce, said that the reason for the existence of a canal was cheap carriage, and a canal should, therefore, only be expected to pay its way. He advocated the state acquisition of canals, and that the canals should be under the control of a local trust acting under the direction of a central body. The canals should be acquired by means of provisional orders, a public inquiry being held in each district before such an order was granted.

Mr. Fred Morton, of the firm of Messrs. Fellows, Morton & Clayton, canal carriers, of Birmingham, pointed out discrepancies in the board of trade returns of canal traffic, stating that in some cases tonnage appeared under various headings several times, and so multiplied the total considerably. He complained of the difficulty of obtaining reasonable terms from railway companies owning canals for through traffic over their parts of the route. The only remedy at present was the expensive one of appeal to the railway commissioners, and the only suggestion he had to put forward for obtaining better terms was that of the taking of the canals out of the hands of the railway companies. The amalgamation of nonrailway-owned canals was, he considered, desirable. It would do away with expenses which in his opinion at present existed unnecessarily. The best unit for

through traffic was, he thought, a 60-ton barge. He did not think the management of canals should be left to local authorities. In such case they would be as badly or worse off than now. He was confident that the state acquisition of the canals would not entail expense upon the ratepayer and the taxpayer. He did not believe that the railway companies were making any profit out of goods traffic; they made their dividends from passenger traffic.

Mr. Charles Robert Dykes, general manager and secretary of the Rochdale Canal Company, said that Parliament had prohibited canal companies from making arrangements with railway companies, and for many years its attitude toward canal companies had been very unsympathetic. A through route like the Rochdale Canal should be worked by the amalgamation of the companies interested in it. For this purpose a local inquiry should be instituted, followed by assessment of value, and finally by the passing of a provisional order by Parliament. Many canal companies were not able to adequately police their property, and had not funds to protect it by fencing, as had the railway companies. In consequence of this disadvantage rights of way had been established by others. He held that the whole of a canal route should derive energy from one electric power company, instead of, as at present, having to get it from a number of sources. Canals should be amalgamated into one national system. A former witness had stated that the leading canals for through traffic emanated from Birmingham. He, however, held that the through route from Lancashire to Yorkshire was just as important, and the traffic was very heavy. There should, in his view, be a cheap method of internal transit alternative to the railway system, for the transport of goods not requiring speedy conveyance.

A larger storage capacity for canals was required. Reservoirs should be enlarged, and there should be side locks. One great stumbling block was the absence of a through system of tolls. The traffic could be worked economically with 100-ton boats, which were preferable to 60-ton boats. Rochdale Canal locks would not take 100-ton boats. Under unified management tolls could be reduced. If £1,000,000 were spent on improvements, the return would justify the capital. The traffic consisted chiefly of coal, heavy minerals, raw material for manufacture, grain, building materials, and general merchandise, which did not require much speed.

Witness would not approve of county councils, municipal corporations, and urban district councils having any part in controlling canals, as it would lead to local rivalry. The Government should buy up the whole canal system and place it under a special government department. The method of purchase should be that adopted in the case of the Indian railways.

### MAIN CANALS ONLY WORTHY OF IMPROVEMENT.

Mr. William Henry Wheeler, a member of the Institution of Civil Engineers, said he had carefully considered the question of the revival of the waterways. He believed it would serve no useful purpose to attempt to restore any of the minor canals, or very few of them, because there would not be traffic sufficient to justify the outlay. He believed there would be an advantage in improving and bringing up to date the main canals connecting the seaports with the

center of England. There should be one uniform gauge; locks and waterways should be enlarged much as Mr. Saner advocated. The work can never be done efficiently unless the managing bodies are carriers. The most successful canals are the Bridgewater and the Aire and Calder, and they are carriers. Taking Birmingham as the center of England, and connecting that first with the Severn and then with the Mersey and the Humber, these are the principal routes which would give the best results. It would involve a very large amount of capital and the work would not pay financially. The main waterways should take 250-ton boats or 300-ton steamers. I do not think enlargement even to take 100-ton boats would pay financially.

The country has neglected its waterways so that the whole trade has been adapted to send that trade by railways; and the reason is that, first of all, they afford a quicker and more certain transit.

There hasn't been a single case within the past few years where canals have been improved which have paid financially. The Manchester Ship Canal has been of immense benefit to the neighborhood, but it has not paid the shareholders. Those really interested in the traffic do not take sufficient interest in it or think it would pay them to find the money to improve the canals. With a long run and a large boat, as in America, freights may be very low, but distances are all short in England.

### CANALS AS AUXILIARIES TO RAILWAYS.

Mr. S. W. Royse. I have been appointed by the Association of Chambers of Commerce of the United Kingdom as one of their two witnesses, and also by the Manchester Chamber of Commerce to give evidence. I am principal of the firm of S. W. Royse & Co., of Manchester, chemical, mineral, and metal merchants.

I have a very strong feeling that the canals could be made very useful auxiliaries to railway transit by consolidation and coordination, if improved to enable them to meet altered conditions. They have, instead, been systematically neglected, as, I think, against the true interests both of the railway companies and of the public.

### NEGLECT OF BRITISH CANALS.

I believe of the 4,000 miles of canals in the United Kingdom only about 230 miles will accommodate boats carrying over 90 tons; 2,000 miles can be used for carrying boats of 40 to 60 tons; and the remainder are only suitable for quite small boats carrying up to 30 tons. Some systems are isolated, and some require connecting with different groups of canals; some require to be made deeper and some wider; and the locks generally made to accord with the different sized canals. There should be a thorough coordination and standardization. I do not think there has been any important inland canal made for the last thirty or forty years. The case has been very different on the Continent. In France the canals are state owned; there are no tolls on the canals—in fact, they are as free as the English highways. In Belgium and Germany they are mostly state owned and the tolls are limited to paying the interest on the money and also the upkeep. Very large sums of money have been

spent by these various countries on their canals, and very large sums have been voted to still further improve and extend them.

In the interior of England there has been a steady going back with respect to canals. I believe something like 200 or 300 miles have been absolutely given up. The improvement of our canals is more important now than it has been; the competition of our foreign rivals is so very severe now that it is very important that we find the cheapest possible means of inland transport. Undoubtedly there is economy in carrying goods by canal in certain circumstances. I think this commission will serve a very useful purpose in ascertaining if the configuration of the country is such that the physical difficulties can be surmounted so as to make our canals comparable with those on the Continent. Most of our canals were originally built for local purposes. They are wanted now for a national trade. The quantity of goods in the shape of raw material and semimanufactured goods, then small, has grown to immense proportions. We are dependent on supplies from abroad to maintain our industrial supremacy.

I calculate that of something like 140,000,000 tons which are imported and exported from this country per annum we only carry by the canals something like 30,000,000 tons, whereas there are 8,000,000 enter and leave the port of Antwerp every year; I believe I would be safe to say 10,000,000. I believe the railroads of this country carry 500,000,000 tons of minerals alone, and yet we, on all our canals, only carry about 30,000,000 tons of all classes of goods; and taking into account that some of the traffic is counted twice in the returns, the figure might be reduced to 20,000,000 tons.

I believe there is little chance of material reduction in railway rates. The capital invested in connection with railways in the United Kingdom works out at £52,000 per mile, in Germany only about £20,000, and in America only about £12,000. Therefore in this country the amount of money on which dividends have to be earned is very large, comparatively; very much larger, probably, than in any other country in the world. I believe the waterways can be made to serve a very useful purpose in transporting slow-moving traffic to and from the interior.

### COST OF CARRIAGE IN ENGLAND, AMERICA, AND ELSEWHERE.

I think the cost of carriage is heavier in the United Kingdom than in any other country in the world.

Take, for example, the case of pitch from Wolverhampton to Swansea, 100 to 120 miles; it costs 8s. 2d. per ton by canal and 8s. 4d. by rail. From Wolverhampton to Liverpool, about 90 miles, it costs 7s. per ton by canal and 7s. 3d. by rail. That is the rate of carriage including the toll. From Milton, near Stoke-on-Trent, to Manchester by rail it is 4s. 7d.; distance about 40 miles. These very same goods can be sent from Dunkirk to Lens, near Douai, about 68 miles, for 1s. 3d. per ton by canal. But it is quite right to say that there are no tolls in France; so that is for the carriage. From Dunkirk to Anzin, near Valenciennes, about 120 miles, it is 1s. 10d. per ton by canal.

In Belgium, for the carriage of the same pitch from Antwerp to Charleroi, about 67 miles, it is 2s. 9d. per ton by rail. From Antwerp to Herve, near Liege, about 90 miles, it is 3s. per ton by rail. Pitch is used to agglomerate coal dust and small coal into briquettes.

I have several instances in regard to china clay. From Cornwall to Oxford, say about 180 to 190 miles, it is 15s. per ton by rail; from Runcorn or Weston Point to Stoke-upon-Trent, about 60 miles, 7s. 5d. per ton to carriers' wharf and 6s. 11d. to consignee's wharf; whereas we can send the same goods from Nantes to La Haye Descartes, near Tours, about 200 miles, for 8s. 6d. per ton by rail. Again, from Rotterdam to Almelo, in Holland, about 90 miles, is 6s. per ton by rail; from Antwerp to Mannheim, about 400 miles, 6s. 9d. per ton by water. Perhaps the next one is the most startling. From Newport News, which, as you are aware is not very far from Baltimore, goods can be carried to Kalamazoo, in Michigan, some 800 or 900 miles, for 9s. 2d. per ton by rail; and from Baltimore to East Liverpool (one of the pottery districts in the United States) it can be sent a distance of 350 to 400 miles for 10s. per ton by rail. The rate on potash from Prague to Hamburg, about 400 miles by water, is 13s. per ton.

These figures show clearly how we are handicapped in this country. One more instance: For iron ore, Ellesmere port to Wolverhampton, about 70 miles, the rate is 5s. 10d. by canal and by rail from Garston to Wolverhampton, 5s. 6d. per ton; from Gloucester to Wolverhampton, about 70 or 80 miles, 5s. per ton by canal and 5s. 9d. by rail; whilst the low-grade phosphoretic ores can be carried from Loraine to Westphalia, 200 miles, for 6s. per ton by rail; and the high-grade Lake Superior ores can be conveyed to Pennsylvania, by rail, boat, and rail, a distance of over 700 miles, for 4s. per ton. Sir Lowthian Bell, some twenty-five years ago or more, after visiting the United States came back and led the manufacturers in this country to understand that we had nothing to fear from competition in America as the ore was too far away from the coal, but it would be perhaps only right that I should mention that the bringing together of the iron ore and the coal has been done at an enormous expenditure for mechanical appliances and in various other ways. The Lake Superior ores, to the extent of something like 15,000,000 to 20,000,000 tons a year, are sent from the shores of Lake Superior into Pennsylvania, and it is by mechanical arrangements and the expenditure of capital that they have been able to bring about what I think is the greatest achievement in the way of cheap carriage in the whole world. The ore deposits are some 50 or 60 miles from the shores of Lake Superior, and the ore is taken thence, and loaded into boats holding something like 5,000 or 6,000 tons or more in four or five hours. They sail along Lake Superior, Lake Huron, and Lake Erie, and they are unloaded in Lake Erie into railway trucks. Then they are taken about 150 miles into the interior of Pennsylvania, and, including the loading up from the bed of ore, which is practically quarrying, it costs 4s. per ton. The distance is between 700 and 800 miles. Cheap transport has largely assisted to develop the iron and steel trade in America.

The low-grade phosphoretic ores in Lorraine and the moderate railway rate, assisted by the Thomas Gilchrist process (a British invention), has contributed very largely to the development of the iron and steel trade in Germany.

In consequence of the cost of inland carriage in this country, now manufacturing industries and extensions of existing industries are more and more being established on or close to the seaboard.

AID FROM NATIONAL AND LOCAL AUTHORITIES.

The Bristol chambers of commerce and other chambers for many years have advocated assistance from local authorities in the improvement of waterways. My opinion is that any complete and comprehensive scheme could not be carried out without aid from local authorities. To do so, it would be a task of enormous magnitude, and it would practically be impossible. The interests of one district are different to those of another, and one dissentient voice might spoil the complete scheme.

The Manchester Chamber of Commerce has advocated that the question of cheaper inland transport by means of inland waterways should be a national one, and should be carried out by the Government or by a national public trust aided by government guaranty. At the spring meeting in 1904 of the Associated Chambers of Commerce the Manchester chamber introduced that question, and the resolution was carried unanimously. At the autumn meeting of 1904 the Manchester chamber introduced a concrete resolution and was supported by the Liverpool chamber. The resolution was carried by 61 votes to 40, but the rule requires a two-thirds vote, and therefore the resolution, although carried, was ineffective. The matter came up again the following spring, and again Manchester introduced the same resolution, again supported by Liverpool, and after a discussion and a meeting in the committee room the following resolution was adopted, with not more than two or three dissentients:

> This association recommends that the improvement and extension of the canal system of the United Kingdom should be carried out by the means of a public trust, and, if necessary, in combination with local or district public trusts, and aided by a government guaranty, and that the executive council be requested to take all reasonable measures to secure early legislation upon the subject.

If a national public trust should be recommended by the royal commission, it is my hope that the Government may see its way to put upon the trusts representatives from different districts of various interest; such as manufacturers, merchants, carriers, agriculturists, mine owners, colliery owners, etc., as well as representatives of the Government, giving the government representatives a controlling voice so far as expenditures on capital account are concerned. Power should be given to the trust not only to build national trunk canals, but to acquire such of the existing canals as would be useful in carrying out their scheme at a price to be mutually agreed upon, or, failing agreement, by arbitration, and I would suggest that power should be given them to build subsidiary or feeder canals. If a canal should be required for purely local purposes power should be given to the trust to call for aid from the local authorities. From the general council of the trust committees should be appointed to supervise and administer certain groups of canals subject to the approval of the trust. The cost of acquiring the canals should be met by the forming of a trust by the Government giving a guaranty of whatever they could borrow the money at. I do not think anyone could form a correct opinion of what the cost would be; but if you put it down at £50,000,000 it would be a very small sum for the acquiring and carrying out of the object in view. I do not anticipate it would cost so much as that.

At the present time the total capital of independent inland waterways is about £22,000,000, bringing in a revenue of about £520,000 per annum. The capital of railway-controlled canals is not published, so far as I am aware, but the net revenue is about £46,000, and the total tonnage carried on all the canals does not amount to 30,000,000 tons per annum.

I would give the trust power to fix tolls, to issue stock bearing government guaranty, and to apply any net revenue, after paying interest on guaranty, sinking fund, and all expenses, in the reduction of tolls.

I would suggest that the Government or the trust appoint two or three eminent engineers to separately survey the country, each to submit his independent report together with his recommendations, always bearing in mind what traffic the canals have to provide for and, of course, utilizing as far as possible existing waterways. They would give their estimates of cost of haulage per ton for the different sizes of boats and means of propulsion, and I would recommend that that be done before the trust enters into acquiring any canals. I am very anxious that the matter be not dealt with in a piecemeal manner, for that might jeopardize the predominant position industrially of this country.

COMPARATIVE COST OF RAIL AND WATER TRANSPORTATION.

Q. 5686. You thought that the rates of tariff on canals would be less, probably, than on a railway; but here Mr. Colson, a former director of the railway department of the ministry of public works, and probably one of the best authorities on this subject, estimates that in most cases in France the net cost of transport is appreciably higher by water than rail. Do you agree with that?—A. I do not know the authority, but I should very much doubt it. There may be instances where the railway rate would be cheaper than the canal, but it would be, I think, quite the exception, for the very reason that there are no tolls.

Q. You are also aware that he says that the railway company "is not allowed to lower rates temporarily nor, in some cases, to a point less than 20 per cent above the canal rates, nor is it permitted to make tariffs which are considered unduly to favor the importation of foreign goods." Are you aware that that 20 per cent is pretty strictly kept to?—A. I do not know.

Q. Therefore the railways may not compete in rates with the canal?—A. The railways in France, as in Germany, are controlled to a very large extent by the state, and therefore they avoid what I would term as unnecessary competition, and if the railways in this country were all consolidated into one great trust, of course on certain conditions there would be an enormous saving, and it would be one of the greatest benefits, in my judgment, that could possibly take place for the traders.

Q. Have you followed at all the promises that were made at the time of the union of the Southeastern and Chatham Railways?—A. I have not.

Q. You are not aware that the Southeastern and Chatham and Dover companies alleged that there would be a large saving of working expenses if what was altogether unnecessary competition should be put an end to?—A. I thoroughly believe so.

Q. Have you looked at what the ratio of working expenses of those two companies before and after the union has been?—A. I have not given it any attention.

Q. You will be surprised to learn that it has very largely increased?—A. I should be surprised if the expenses have largely increased.

Q. As a matter of fact, that is so, and, of course, competition, such as it is, has to a great extent ceased; that is to say, it was supposed, for instance between Dover and London, that a large saving would be incurred by not running competitive trains?—A. Certainly. Trains do not run by each line, but two trains have always to be run as before.

Q. May I ask you to look at Mr. O'Beirne's report, on page 38 of this return, in which he says:

> Where the state has created canals to compete with the railroads, it would actually have been cheaper, and also more advantageous, to build entirely new competing railway lines. Even in the case of a natural waterway especially adapted for navigation, such as the Seine, the money which, as we found, has been expended to obtain first-class navigable conditions represents the cost of establishing a new railway line on a cheap scale and under favorable circumstances. On the other hand, the expense of enlarging the capacity of an existing railway line is small as compared with that of building a new line even under the cheapest conditions; and therefore if the state, instead of using its funds to create, improve, and maintain waterways to compete with the railroads, had applied them to increasing the capacity of existing railways, and had used its controlling powers to bring railway competition, it would seem that the same results would have been attained at a large saving of public money.

You did not know he had written that?—A. I did not know. I can conceive it might be so under certain circumstances, but the very fact of the State of France spending so large a sum of money on the extension of the waterways indicates, at least, that the water carriage, in certain instances at all events, is cheaper than railway carriage.

Q. You are, of course, aware that French railways, with the exception of a few running to the southwest, are practically monopolies?—A. Yes.

Q. There are seven big companies not allowed to compete, or which do not practically compete with each other?—A. That is so.

### GERMAN WATERWAYS.

Mr. William Pasley Tyler. Have been manager of the Berlin Crane Company. Was in Berlin looking after that business from 1884 to 1905. We carried goods between Berlin and Hamburg by cargo steamers, which we call express steamers, of which there were seven. We also had other steamers, barges, and auxiliary craft.

I wish to quote from one of the reports of the British embassy in Berlin, in which Mr. Gastrell says (1903):

> During the earlier period of the development of the railways up to 1875 there existed in Germany, as in most other countries, a feeling that inland transport by water was doomed to languish, it being thought impossible that it should ever be able to compete with the extensive railway systems. Even the best informed persons in the early days of the German Empire, after 1871, only believed in a survival of canal transport as competing in certain districts with the high road. Since 1875, however, public opinion looked more favorably on the possibilities of the development of the inland waterways. One of the reasons that brought about a reaction in favor of extending the canal system was the existence of some dissatisfaction with the comparatively higher rates of the state railways,

and many persons were glad to avail themselves of the low freights on the waterways, which were not under the control of the railways. The rapid extension of the waterways was due to the great increase of technical knowledge in connection with river and canal works, to the improved form of ships, and to the better appliances for haulage. At a very early date it was realized that the old style of canal with small craft and slow towage was no longer able to compete at all with the railways, and that the waterways, in order to become of practical use, must be able to accommodate larger vessels of about 450 to 600 tons towed by steam tugs. In fact, in most parts of the Empire the chief inland waterways, both natural and artificial, had to be adapted to steam traffic by replacing the many smaller locks by a few large ones. The actual length of the waterways in 1900 within the German Empire was, according to imperial statistics, 8,798 miles.

Mr. Gastrell gives a table showing ships navigating German waterways. Excluding sea shipping, the number of steamers increased from 830, representing 33,155 tons, in 1882, to 1,953, representing 104,360 tons, in 1897, there being among them an increase of from 9 to 56 steamers of over 300 tons. The number of other vessels, also, for inland shipping, rose from 17,885, representing 1,625,111 tons, in 1882, to 20,611, representing 3,266,087 tins, in 1897, and these figures show the enormous increase in the size of the vessels. There is an increase here of from 687 to 2,463 vessels over 300 tons.

Then Mr. Gastrell goes on to point out the improvements between 1890 and 1900 in the natural waterways of Prussia. He notes especially the laws of 1879, 1880, and 1882, for improving the various waterways at a cost of over £4,500,000, the object of these laws being to regulate the various rivers, and thus give them, even in times of drought, if possible, broad and sufficient streams to allow of traffic at all times of the year, excepting in times of severe frost, which recur nearly every winter. It is a matter of fact, however, want of rain creates drought periods, which no amount of regulating without locking will obviate.

Another bill came before the Prussian Landtag in 1894 providing for an additional expenditure of over £1,000,000 for works on various rivers.

Wherever the necessary depths can not be otherwise obtained they have canalized rivers. In 1880 there was a grant of £270,000 by the Government, and nearly half of this was subscribed by the town of Berlin for canalizing the Spree in order to make it navigable for 600-ton boats, especially for boats from Hamburg to Breslau.

The upper Oder has been canalized from near the frontier at Cosel, for 53 miles, at a cost of £1,200,000, in order that the upper Silesian coal might be carried right through from that place to Breslau instead of by train to Breslau for shipment to Berlin and other places in barges. This canal was made for 400-ton boats.

Between 1890 and 1900 thirty harbors of refuge were built for steamers and barges to use in times of flood and ice on the larger rivers. The expense of these is borne by the towns in certain cases, the Prussian Government contributing largely in certain cases. The total cost to the Prussian Government for this work was about £200,000. The local authorities are expected to provide conveniences for transshipment and loading and unloading and roads of approach, and they do it in a great measure; in other cases those interested in shipping provide them. On account of the increase in shipping, due to the improvement of the waterways, local authorities, inland shipping companies, and others, between 1890 and 1900 built new quays

and improved existing ones at a cost of £3,000,000, including £900,000 for Cologne alone, these improvements being supplied with all modern equipments. These figures are for the State of Prussia alone; but they are doing the same thing all over Germany.

The traffic on the waterways has also been fostered by light railways, and also by connecting lines built with state aid.

The cost of waterways in Prussia alone in ten years—1890–1899—amounted to £15,000,000, of which nearly £6,000,000 was for ordinary recurring expenditure. Ordinary recurring expenditure rose from £700,000 in 1890 to £883,000 in 1899.

On the Rhine in 1887 there were 275 steamers aggregating 17,000 tons. In 1897 there were 418 steamers aggregating 38,900 tons. In 1904 there were 586 steamers. This is from the latest statistics to be found in the Rhine Calendar. In 1887 there were 2,731 barges of 570,900 gross tonnage; in 1897 there were 3,076 barges with 1,157,000 gross tonnage. The great improvement in the Rhine waterway accounts for the increase in the tonnage of barges. I have given the latest figures obtainable. There has been great development since 1897. These figures are for the German fleet alone and do not include the Dutch boats. The whole Rhine fleet, in August, 1904, amounted to 10,000 boats, with 29,500 men. That I obtain from the Rhine Shipping Register.

In 1887 the largest inland barge on the Rhine was 1,200 tons. In 1904 the largest was 2,340 tons, being 328 feet long, 39 feet 4 inches broad, and 9 feet draft. It is within my knowledge that barges of 2,000 tons go up as far as Mannheim, and I think even farther up.

The Prussian Government has always been of opinion that an extensive and growing canal system is not opposed to the interests of the state railways (on which the state depends for a large part of its revenues), but that, on the contrary, the two complete one another and should work well together in the interests of the public, and therefore of the state as a whole. Their policy has been that certain traffic should be carried by water to the relief of the railways of any congestion of bulk traffic; but the canals and rivers in Germany carry every kind of traffic. The Prussian minister of public works, who also has the railways under him, being the railway minister, has publicly declared that the assistance of the waterways is necessary to the railways, in order to cope with the ever-increasing traffic. I know that Minister Budde, now dead, said this, and I am not sure that a predecessor did not say the same.

Mr. Gastrell's report of 1905 refers to the great scheme contained in the law of April 1, 1905. The cost of this is £16,728,750. The further the Government goes on in the improvement of the waterways the more beneficial they find it to the country as a whole in the development of the resources and industries of the country. In this new law the sum granted to the Rhine-Weser Canal and accessory works is £12,500,000. That canal proposes to join up the port of Bremen with the Rhine. Then there is a scheme for joining up the Elbe with the Weser by means of the Hanover-Elbe Canal. The part between the Weser and Hanover is to be made, but the rest of the route is held in abeyance for the present. If that is carried out and the Elbe and the Weser joined, all the German rivers will be linked up together, and there would be through communication through all the north German rivers for 600-ton barges. These again

would be linked up with the south German rivers, and also with the Russian waterways on the east.

A sum of £2,150,000 has been allocated to the building of the new Berlin-Stettin Canal, for 600-ton barges, the present canal only serving for barges up to 240 tons. Over £1,000,000 goes to the improvement of the waterway between the Oder and the Vistula, and nearly the same amount for canalizing part of the Oder. Before these schemes are proceeded with the various provinces concerned or other public bodies interested in them are obliged legally to undertake certain pecuniary obligations before the 1st of July of this year, otherwise these canals will not be built, as the Government does not intend to find all the money. The Berlin-Stettin Canal, for instance, will not be constructed unless the districts concerned guarantee to make good any deficit up to £32,750 per annum on the working expenses, and also to pay 3 per cent on part of the money, on £725,000, and also certain sums for amortization. On the opening of the Rhine-Weser Canal tolls are so to be fixed to be charged on these regulated rivers that the proceeds shall afford a fair rate of interest on the capital expended by the state in improving the rivers for shipping purposes, and also to provide funds for gradual amortization.

This is a new departure for Germany, although on regulated rivers having locks there have always been lock dues charged. For instance, between Berlin and Hamburg, running half way on the Elbe and the rest of the way on the Havel and the Spree, the three locks on the two latter rivers have levied tolls on all barges passing through, but on the Elbe there were no charges whatever. There are none on the Rhine.

It was shown to the Prussian Landtag in 1901 that the Berlin-Stettin Canal traffic was diminishing on account of having to be carried in smaller boats than on the Berlin-Hamburg waterway, where 600-ton boats ply. To carry the whole bulk of the traffic between Berlin and Stettin on the state railway was out of the question. Prussia has the greatest interest in putting her largest seaport town in a position to compete with other German seaport towns, for instance, Hamburg, which is not an integral part of Prussia, but a state in itself. The only way to wrest the traffic from Hamburg and other German towns and bring it via Stettin into a Prussian seaport is to build a larger canal. At Liepe there is a sheer fall of 118 feet, where a lock stair is to be built with five locks of 23 feet 7 inches fall each, and in addition an inclined plane is to be constructed by the side of the lock stair, instead of a second set of locks, which would require too much water. It will take five years to build the canal. The annual cost of its upkeep is estimated at £33,000. The length is 62 miles, Berlin to Liepe or Hohensaathen, where the canal joins the Oder. The whole distance from Berlin to Stettin is 111 miles. The cost of the canal is estimated at £2,100,000. This 118-foot drop with its inclined plane for 600-ton barges is apparently not regarded as an obstacle to carrying out this work.

The government authorities estimate that the effect of the construction of this improved canal will be to reduce freight charges to 1 mark per metric ton as against 3.70 marks or 3.40 marks per ton for first and second class goods between Stettin and Berlin as at present. Personally I should doubt whether they will be able to get down so low as 1 mark.

In the case of some of the rivers, the Oder, the lower Havel, and the Spree, for example, the draining of large tracts of country has been a motive for the improvement of the rivers.

There are three locks between Hamburg and Berlin, a distance of 236 miles, and the total charge for lockage has not been large. Between Berlin and Stettin there are 22 locks. Where there are many locks the charge is proportionally less; otherwise the burden would be too great. Lock dues are graded according to the classes of goods, of which there are four. The barges are also classified for purposes of insurance. Class 1 may carry freight of any description; class 2 may carry freight of lesser value; class 3 are licensed to carry wood, stone, brick, coal, etc. Cargoes carried on second and third class barges pay higher insurance premiums than on first class.

Different carrying companies combine on the different rivers to keep up the freight rates, but these combinations are very unsatisfactory in operation, as so many means are found of evading them, and outsiders are encouraged to build new vessels. There has been fierce competition in Germany in all branches of commercial industry. Consequently shipping companies have been gradually fusing into larger concerns. The largest shipping business on the Elbe, the United Elbe Shipping Companies, Share Company (Limited), is one result of this fusing process. It operates a fine fleet of 137 steamers, 310 barges, 180 lighters, and a number of auxiliary steam vessels.

The control of the canals being in the hands of the Government, there is no carrying on them by the controlling authority. The Government charges its dues, but it only requires so much dues for canalized rivers as shall pay for fair upkeep of the canals.

Berlin has risen to great importance as a canal station, especially since the Spree was made accessible in 1894 to vessels of 600 tons. Berlin radiates to Stettin, Hamburg, Lubeck, Breslau, and to the stations of the upper Elbe. In 1882 the first two cargo steamers to run between Hamburg and Berlin were built, carrying 90 tons each. There are now 13 of these cargo steamers keeping up a daily service each way, the largest carrying about 300 tons. They tow one or two boats upstream and as many as five down. In 1882 they used wooden barges, carrying up to 300 tons. Now they use iron boats, carrying 600 tons.

On the Elbe twenty-five years ago 500 or 600 ton barges were considered large. Now there are boats of 1,200 tons. Steamers have increased in the same ratio in power; tugboats of 1,200 horsepower, taking 6,000 tons in tow, are now in use. At times, owing to intense competition, freights are ridiculously low, and of course the railways have not a chance of competing for the traffic carried by the steamers and barges, especially in summer. Rates from Berlin to Hamburg vary from 2s. to 3s. per metric ton for heavy and cheap goods, up to 10s. for miscellaneous and light cargo, for downstream traffic. Upstream traffic ranges much the same, although the expense of carriage is greater. Sometimes, under keen competition, oranges are carried as low as 3s. 6d. per ton a distance of 236 miles, running in two days from Hamburg to Berlin. Private barges have often carried corn or other produce from Hamburg for hundreds of miles for nothing for the sake of being towed upstream, in order to get cargoes down at paying rates. There is an enormous fight going on between the big companies for the upstream traffic. There is a great

excess of supply of vessels over the demand on most of the streams of Germany, so that even in times of low water rates very often remain low. It seems to me there is not very much profit to be made in the carrying trade. I was very glad to get rid of the business. Frost interferes with traffic so that vessels have to lie up for weeks or even months, but with the powerful steamers now used and the ice breakers employed by the Government there is not so much difficulty with ice as formerly.

The first-class firms and companies only carry the better kinds of goods as a rule, not touching such traffic as iron, coal, sand, brick, etc. Single owners of barges manage to carry such traffic more cheaply, because they often work in families. I have never seen towage by mules or horses in Germany; it would be looked upon as ridiculous. The rates for towing from Hamburg to Berlin were as low as 10d. a ton this summer.

The locks are all served by government officials.

The district council of Tetlow are building a canal at their own expense, about 25 miles long, for vessels which wish to pass Berlin without stopping there. They expect to make a great deal of money, firstly, from the traffic and, secondly, from the land which they have bought up and which will be used for building factories and dwellings. The canal will cost £2,000,000. It will accommodate 600-ton barges.

The tug rate in the Tetlow Canal is an arbitrary rate of 6d. per metric ton or ¼d. per ton mile. This seems excessive, and will probably have to be reduced if the builders wish to have their canal extensively used. The towing is done by electric engines, running alongside the canal on rails. This is experimental and of doubtful value. I think this is a very fine specimen of how canals should be built for 600-ton barges, with all the latest improvements and with all the German experience.

In England we are paying freights out of all proportion to rates in other countries, because we have neglected our inland waterways. We should spend the necessary amount to put our inland waterways in a thorough, efficient, and up-to-date condition. I see no other way but that the Government should buy the waterways out and put the whole thing under the board of trade as a center of government, decentralizing afterwards as much as may be found necessary, just in the same way as the waterways of Germany are decentralized; certain waterways are put under certain government presidents, and these people are all responsible in the same way as the railway people are responsible under different managements for their particular part of the railway or the inland waterway under their control. I do not see why the railways should be against such a scheme, because it is proved by experience, not only in Germany, but in Belgium and France, that the railways can only gain in the end, especially if it be true that our English railway companies carry heavy traffic at a loss.

It is of the utmost importance that as high a gauge as possible for canals be fixed upon, for the larger the vessels the cheaper the transport. In Germany they have decided that the most practical thing for them to do is to provide for 600-ton barges in their new canals and those they are improving.

I do not see why the wealthier districts and large towns should not aid in improving the waterways, so the Government would not have the whole burden. I think factories would spring up on the banks of important waterways, and that would be a relief to the congestion of our towns.

The railway rates in Germany are two or three times higher than water rates for all goods, and there is practically no competition between the two. Express steamers carry for half the railway rate or less, and for ordinary traffic compete with the railways in the matter of time, but not in the matter of railway express business, which is quicker than the boat service.

By a new law in Germany boats are to tie up at night, but hitherto they have run night and day in many instances.

In Germany waterways serve agriculture greatly, especially in eastern Prussia. They carry a large amount of corn and hay. All the summer hay barges come up to Berlin.

Government supervision of the railways and canals works very well in Germany. Chambers of commerce are listened to very carefully in Germany, but I think have no representation in the management. Hamburg is a State in itself, and the port administration there is controlled practically by the traders there, I imagine; by the municipality directly, but the traders naturally have a great voice. For instance, the Hamburg-American Liner Company have a very great influence.

One thousand two hundred-ton barges ascend the Elbe nearly to Aussig, in Bohemia; certainly beyond Dresden.

We use warehouse barges, which are floating warehouses, for storing stuff which has to go out from Hamburg, because there is not enough quay accommodation.

### SCOTCH CANALS.

Mr. J. Inglis Davidson gave evidence as to the Forth and Clyde Canal and the Union Canal, the use of which, he said, was very limited. Railway facilities were more suitable to the average farmer, and canal traffic had much diminished. It would be difficult for farmers to cooperate in regard to canals. There was still a large traffic in pig iron on the Forth and Clyde Canal.

Mr. F. B. Girdlestone, general manager of the Dock Estate, of Bristol, did not think the canals of the United Kingdom got their proper share of trade. This was probably because the service was inefficient and the charges too high. There was no doubt if the canals of the country were modernized and properly managed they could be made of great use. There should be strict control exercised by some government department.

### THE TRENT NAVIGATION, ENGLAND.

Mr. Frank Rayner. Am an associate member of the Institution of Civil Engineers, and engineer and joint manager of the Trent Navigation Company. Am a member of the committee of the Association of Independent Inland Waterways. Have made a close study of the whole question.

After the advent of railways the Trent Navigation Company failed to improve and develop the navigation as they should have done. As in many cases, they thought the concern was doomed. The traffic fell away and dividends ceased. With a view to check the loss of traffic the company became carriers, the only policy which could save the undertaking from becoming derelict. They had good modern boats constructed and bought tugs and erected good depots. Our traffic as carriers consists mainly of imported goods which come into Hull or one of the other Humber ports, and which we carry up to Newark or Nottingham or wherever its destination may be, and also traffic from places on our system, or on the tributary navigations, which is destined for export at one of the ports.

The average mileage per ton of traffic carried by our company is about 70 miles. Practically the whole of the goods traffic is towed by steam tugs between Hull and Nottingham. Our principal difficulty is the uncertainty as to the depth of water. In a year of satisfactory rainfall the company can increase its traffic and obtain rates which yield a fair profit; but in times of short rainfall the headway which we have previously made is lost. If the river were in a better state as regards depth of water we should have a great increase of traffic. Traffic has responded well to such small improvements as we have made.

### INFLUENCE ON RAILWAY RATES.

The influence of the navigation on railway rates has been very pronounced. Taking Nottingham as a center, it may be stated that from Hull, where there is an effective water competition, you get the lowest railway rates. From places such as Liverpool and Manchester to London, where there is a partial, but a less effective, competition, you get a higher rate, and from other places where there is no water competition at all you get a higher rate still. Where there is but a small difference between the railway and water rate, the railway rate has been reduced in consequence of the waterway competition. That is so fully appreciated by traders in the Nottingham district that in some cases they will actually pay us railway rates for the purpose of securing the continuance of our service. With plenty of water in the river our boats carry 70 to 80 tons. It it our policy to improve all the locks, bringing them up to a standard size of 180 by 30 feet, so they will take a tug and three of the largest boats on the river through at once. We run them in trains of three boats and a tug. It is the transshipment, made necessary by the shallowness of the river, that makes the cost of handling traffic on the Trent so heavy. We hope to abolish it when our works are completed, to a certain extent; there will always be a certain amount of transshipment; we should have consignments for places above Nottingham that it would not pay to send Hull boats to, and we should use smaller boats for such service. The principal transshipment has to take place somewhere below the first lock.

A thoroughly efficient barge canal is the cheapest means of handling traffic for long distances. I do not think it would pay on long-distance waterways to have headroom at all bridges to permit the bringing up of coasting vessels with fixed masts; it makes the cost of construction so tremendous. I think a depth of 6 feet, which we

propose to have on the Trent, is sufficient for all ordinary purposes. The Aire and Calder have a greater depth, but that is really for the coal compartment boats. I think a large proportion of the general merchandise on the Aire and Calder is carried in boats drawing less than the coal boats. We are proposing to improve our canal so as to permit vessels of 300 tons to go up to Nottingham, but I do not anticipate any large number of boats of that size using it. I doubt if it will be found economical for vessels coming across from the Continent to ascend the rivers; it will be more economical to employ vessels of larger tonnage and transship at the ports. I think that such a navigation as the Trent should be able to accommodate lighters up to 150 tons.

Canal companies should amalgamate. A large number of authorities make it more difficult to arrange for through tolls. If the Trent navigation were to be dealt with by a trust or public authority, that authority ought to have control of all the waterways which, by nature, would drain into the Trent Valley. I think the grouping should follow natural rather than artificial lines. I think authorities controlling an extensive system should be carriers, because it insures to the public a properly organized system. In my opinion a good deal of the difficulty which canals have passed through has been caused by the fact that on so many of the waterways there has been no properly organized body for quoting rates and dealing with traffic and providing facilities for handling it—providing a regular service.

### WATERWAYS INSURE COMPETITION.

I think there is always bound to be competition where you have an effective waterway, because you can always count on the one-boat and two-boat men coming in and cutting for traffic where the rates are higher than are justified; and even large traders or millers may put on their own boats if a ring is formed to put up rates.

In the bill as originally lodged for improving our navigation power was sought for certain municipalities greatly interested in the Trent to make contributions; but it was fiercely opposed by the railways in the district, and the Trent company felt that it was a proposal that they would hardly be justified in going to the great expense of fighting through committee.

### AGRICULTURAL TRAFFIC.

We have a little agricultural traffic on the Trent; not very much. We pass through a good agricultural country, and we anticipate, when we can give better service, a large increase of agricultural traffic, including the carriage of corn to the centers of distribution, for instance, and the carriage of cake and other materials needed by the farmers. A good deal of manure comes down the river from the towns.

A large proportion of the waterways of England are wholly artificial constructions and artificially supplied with water, differing from a river in crossing a summit level.

IMPROVEMENT OF MAIN WATER ROUTES.

Mr. STEPHEN JAMES SANDERS. I am traffic agent of the Stanton Iron Works, Nottingham, and one of the representatives sent to the commission by the Mining Association of Great Britain.

If we are to improve our export traffic we shall have to find means of cheaper communication to the harbors. The railways have done, no doubt, the best they can, but they have been unable to meet us and we have appealed to the canal carriers. Last year and the year before we paid them £14,000 for carriage, for export. What we need is a system of conveyance by canals so that the boats can go alongside the vessels at the ports.

In the first instance I would provide for improving the two main routes, from the Mersey to the Thames and from the Severn to the Humber, so they would take boats carrying 50 or 60 tons, which I think would be more satisfactory than larger boats. They are easier to deal with. If you have a small order you can use one boat; if a large order, four or five boats. There would be accommodations on most vessels for five boats at a time to be unloaded at different points, which would be more expeditious than unloading one large barge. Fifty-ton boats could be built capable of working safely to the docks on the Mersey, Thames, Severn, and Humber. The locks should be enlarged to receive five boats and a tug. This would reduce the cost of haulage so that 250 tons would be conveyed 50 miles for less than the present cost of the same weight 20 miles.

WATERWAYS REDUCE FREIGHTS AND HELP RAILWAYS.

Improvements on the Aire and Calder Canal reduced the cost of carriage of colonial wool from London to 18s. per ton last year. Thirty-two shillings and a rebate of 10s. was the railway charge. That has improved the trade in the heavy woolen district materially, thus indirectly benefiting the railways. The canals help the railways very greatly, and they will never enter as real competitors, owing to the small amount in proportion of traffic which they would carry. There is a tendency for manufacturers to leave the inland districts and go either to the towns or to the seaside, on account of the lack of transport facilities. If they remained in the country it would be to the benefit of the railways. It would be to the interest of the railways to find the whole of the money for carrying out the improvements of the canals.

I think such towns as Nottingham would come forward with contributions if the Government should improve the Trent up to their town.

COST OF CARRYING.

I have made some figures on the cost of carrying in a 25-ton canal boat and by railway, the boat being towed by a horse. It works out at 0.3d. per ton per mile by the boat and 0.05d. by rail. With a tug towing five boats of 50 tons each I make the cost 0.08d. per ton per mile.

ONE CONTROLLING AUTHORITY.

There should be one controlling authority for the canals, which should be worked as one continuous system. I should oppose any formation of trusts or any expensive system of management. The Government should take over the main system of canals as trustee, fixing a list of tolls, basing the maximum on the charges now made by canals not owned by railways, guarantee the owners the average dividends of the past five years, and collect all tolls for working expenses and repayment of loans.

DECADENCE OF CANALS.

Mr. George Hatton, managing director of the Earl of Dudley's Round Oak Works (Limited), Brierley Hill, said he had held that position from the formation of the present company, and also represented the iron and steel trade of the district at the request of the South Staffordshire Ironmasters' Association. Many years ago canals were more largely used for the distribution of the products of South Staffordshire than at present. He attributed the change largely to the railway control of canals, to the absence of any progressive spirit in canal enterprise, and to the difficulty in obtaining through rates of tolls, to the large number of locks which impeded the traffic, and the gradual silting up of the canals. He was of opinion that improved trunk waterways from the Midlands to the leading seaports would be highly conducive to the prosperity and development of the district. Several schemes for reaching, with a better canal service, one or other of the available seaports had been under consideration during the past ten or fifteen years, but none had met with sufficient financial support. The last proposal, and the one most likely to be financially successful, was to make an entirely new canal from a point near Birmingham through the iron and coal districts of South Staffordshire to Wolverhampton, thence via Stafford to Stoke-on-Trent and the Potteries, and ending at Winsford in Cheshire, at the head of the Weaver Navigation, giving access to Liverpool. The distance is 61 miles. If such a canal cost £30,000 or £35,000 per mile, it would be a better commercial investment than the expenditure of £10,000 per mile in widening and deepening existing canals. The canal should have protected sides to withstand the wash of steamers. It should accommodate steamers of 250 tons capacity or barges of 300 tons capacity. The Birmingham Canal Navigation should be deepened and where practicable widened. The adoption of hydraulic lifts where practicable, and a certain amount of pumping in other cases, would no doubt be necessary.

For the purpose of accomplishing what he advocated it would be necessary to place the canal system under control of a national trust, with power to raise money for the work under government guaranty. The chief disability under which the district of South Staffordshire suffered was the prohibitive cost of getting its heavy manufactures to the port of shipment. With such a canal as he advocated the present cost of carriage could be enormously reduced, while the time taken need not exceed that now taken by the railways.

## RÉSUMÉ BY RAILWAY NEWS.

[From the Railway News (London) Sept. 15, 1906.]

The case for those who advocate the development of canals and inland waterways has, we imagine, from perusal of the evidence before the royal commission, been fully outlined. The resumption of the sittings of the commission after the present vacation would, therefore, seem to imply the elaboration of the obstacles, surmountable and otherwise, which impose their resistance to the expansion of this means of transport. Accordingly it may be expected that the railway companies will have something considerable to say in respect of railway-owned canals, so that to railway men the investigation is doubtless approaching its most interesting phase. What there is to be said in this regard the future will disclose, but it would appear that little difficulty will be found in demonstrating that, speaking generally, water transit for Great Britain is out of date, notwithstanding that a large amount of traffic is still water-borne.

As regards the line of argument, doubtless a great deal of detail will be advanced concerning railway rates as opposed to the cost of canal carriage. A noteworthy feature has already been brought out, viz, that the railway competition has led to a lowering of canal charges to the extent that certain canals now carrying half as much again as formerly show receipts considerably less than in their earlier days. As concerns the time occupied in the transit of goods, it has been suggested to the commission that by special services, with day and night traveling, the speed of canal transport might rival that of the railways from collection to delivery. No doubt by taking extremely anomalous cases—i. e., those most favorable to the canals and least favorable to the railways—this might be supported in a few instances. It will, however, we opine, be needless to do more than isolate them so as to show their wholly exceptional character. Indeed, it is to be expected that the matter will be kept on the higher ground of the inherent advantages—that the railway can go practically wherever required, whereas the canal routes are unavoidably circumscribed and deflected by the configuration of the country, and so on.

Probably, however, the vital point is bound up in the allegation that the railway-owned canals have been strangled in order that the owning companies might secure the traffic to the rails with greater profit, or desired to safeguard their interests against competition. On this point it seems already acknowledged that the advent of the railways led in the early forties to a rapid withdrawal of the traffic from canals, in consequence of which in some cases the canal companies displayed great eagerness to part with their undertakings, while in others the railways were even bound under their acts of incorporation to acquire them. But it must be borne in mind also that this desertion of the canals has progressed steadily ever since, and it is not yet inactive, as recent instances will show of customers giving up the canals and using the railways or adopting road traction instead.

The questions involved in the factor of water supply have been noticed in some detail in previous papers, and it will suffice to recall the rapidly growing demand for supplies for the domestic and other needs of large cities (necessitating the control of watersheds and the

conservation of water in vast reservoirs up and down the length and breadth of the land), and the heavy and accelerating requirements on every hand for industrial purposes.

Touching upon the condition of the canals, comparisons may be expected of canals to which identical conditions apply and where the railway-owned waterway has been maintained so as to admit of the traffic passing, but at a yearly loss, as against private canals, where the absence of funds, coupled with the fact that the receipts were for years less than the expenditures, has brought the canal either to the point of absolute abandonment with official sanction, or to such a condition that it is unnavigable and useless, and, possibly, even a nuisance. Evidence will perhaps be adduced also showing that on many of the inland canals the water supply procurable for certain lengths is already insufficient, rendering it practically hopeless to consider any question of making the navigation available as part of a through route with a gauge in conformity with the general trend of opinions expressed before the commission, viz, that the barges in use should have a tonnage capacity of 60 to 100 tons.

Stepping aside from these considerations and others of a similar kind which are sufficiently obvious to make recapitulation unnecessary, we would submit that too much importance can hardly be granted to the sensitiveness which canals, as water channels, present to the natural phenomena of the English climate; i. e., to the influences of frost and fog and abnormal rainfall. It is happily many years since a severe visitation of either of these widespread drawbacks imposed its obligations on this country, but this must probably forecast an approaching recurrence rather than the elimination of the risks. It is therefore worth while to consider what these risks imply, and as these are sufficiently appreciated as related to present conditions, it is advisable to look to the future should changes come about as to the result of the commission's endeavors. We would therefore assume that the State has seen its way to assist the canal systems, possibly to the extent that, although not remunerative in themselves, the canals have been made of greater utility to the traders they serve on grounds that the whole community is thus also the gainer, dubious as this contention is. The result necessarily would be that the railway operations would be adjusted correspondingly; i. e., that the railway accommodation and provision of wagons and appliances would conform to the altered circumstances, with a slight margin for abnormal circumstances. Next ensues either a severe frost or a drought of, say, two months' duration, or, possibly, serious floods; and long and important sections of the canal become impassable to the vessels in use, either from the closing up of the water with ice or because the head of water dwindles down to such extent that its depth, or the difficulties of lockage, puts the passage of the barges out of the question; or else the towpaths become unfordable and the canal itself out of sight. If in the aggregate only a week of these conditions prevailed, in what degree would paralysis of industry develop? The question is one of the most serious and far-reaching import, for not only the manufacturers, but also the immense totality of workingmen and their families would be affected, and, moreover, the standing of the nation in the world of commerce might be vitally injured. And this because the margin of elasticity in the

railway provision would naturally be quite unequal to the unexpected call. It is not beside the point to state that the occasion when the worst results would follow would be if the country were engaged in an overseas war, such as the South African entanglement.

On the other hand, the railway organization and equipment closely approximates to an exact science, and can always wait pari passu on the traffic needs, with a fairly narrow emergency provision; and so long as they remain the recognized carriers, the companies would view with equanimity the natural mutations, short of widespread convulsions of nature, such as an earthquake upheaval, impossible to guard against. In conclusion, the gist of the matter, as viewed from the standpoint whence these considerations flow, is that canals and other narrow waterways can not be accepted as dependable; whereas reliability is the first essential in railway working. Therefore, it would ill become a nation whose chief effort is toward efficiency to do aught that detracts from the principal means at hand leading to that end, being, indeed, the means on which all other aids to efficiency largely depend, viz, the finely organized and well-developed railway systems of these islands.

## IRISH CANALS.

Mr. Henry Eagan, chairman King's County council, Ireland, said the chief objections to the present condition of the Grand Canal were the slowness of traffic and an insufficient supply of water. In his opinion an electric motor system might be applied with advantage. Again, the bridges over the canals were a great hindrance. They were built one hundred years ago and were quite obsolete. The gradient was exceedingly steep, as much as 1 in 5, and accidents resulted in consequence. Except as to bridges he did not think the district council or county council would contribute, and outside people would object because they would not gain. Local bodies would not contribute to the deepening of the canal. The tolls at present were quite excessive, and should, in his opinion, be reduced. On the Shannon he believed that the complaint was mainly against the board of works. He was in favor of the canals being under state control. If state control were established no doubt local bodies would be prepared to cooperate in the work so far as possible, but he feared the King's County council would not undertake any large financial responsibility. A considerable amount of improvement would have to be carried out in the canals of the country if they were to be under state control.

Mr. William Field, chairman of the transit committee of the Industrial Association, believed the rates of transit charged by the railways and canals were the greatest bar to the prosperity of Ireland, and unless some different system were adopted in the management of the railways and canals there was no hope for the commercial prosperity of Ireland: the commercial development of Ireland instead of increasing would decrease. By economical management the traffic of canals might be developed a great deal, but the traffic had been killed. Neither the Grand Canal nor the Royal gave facilities for a fine class of traffic. He advocated the existing system of management and nationalization of both railways and canals.

At the sittings in Belfast the general opinion was in favor of the nationalization of the waterways.

### AMALGAMATION OF ENGLISH CANALS.

Mr. HORACE MAYHEW, coal owner, of Broughton Hall, near Chester, stated that one of his collieries had a frontage of 4 miles on the Dee. There was sufficient coal for the next hundred years, and if there were increased facilities for shipment there would be practically no limit for the distribution of the coal, more especially in the North Wales market. It was of national importance that the coal fields in Flintshire and Denbighshire should be developed by the cheaper rates of the water carriage.

Mr. F. W. SUMMERS, chairman of Flintshire County council suggested that in financing an improvement scheme the Government should advance the money and the county councils take over the responsibility of upkeep, such as levying rates for any deficit in the working.

Mr. C. E. GREENALL, on behalf of the Kendall Chamber of Commerce, said that since the London and North-Western Railway Company had taken over the control of the Lancaster Canal the district had not developed as it would have done under independent control.

Mr. GARDNER, a trader on the Grand Junction Canal, believed that exisiting canals could be altered at comparatively small expense so as to provide a waterway on which vessels conveying 100 tons could be used. Longer locks should be introduced through which the barges could pass more quickly, and thus reduce the cost of carrying. The standard size of a canal should be 35 feet to 40 feet in width and 6 feet in depth, exclusive of sloping banks. A great advantage was to be gained with wall-sided canals.

Mr. JOHN GLASS, manager of the Regent's Canal, laid before the commission a scheme for converting the canal into one for 300-ton barges. The approximate cost, he estimated, would be £200,000. The Regent's Canal was an essential part of a scheme either of inland waterways or of improving the port of London. Any large system of inland waterways must have a dock. A scheme for amalgamating the Grand Junction and the Regent's canals had been talked over privately.

Mr. GORDON THOMAS, of the Grand Junction Canal, would like to see the canals of the country amalgamated, particularly those between London and Liverpool, and Hull and Bristol, and would like to see them placed under one control. The legislature had allowed the railway companies to come in and practically sever the canal system by taking up canals which formed links in the system. In an amalgamation scheme it would be necessary to include canals now controlled by railways and forming links in a system. A great increase in traffic would follow amalgamation and improvement of canals. The main line of canal should be brought up to one standard of width and depth and adapted to a modern form of traction.

### RAILWAY MANAGER'S VIEWS.

Mr. SAM FAY, the general manager of the Great Central Railway Company, said that company was interested in one hundred and sixty-odd miles of canals in Lancashire, Cheshire, Derbyshire, and South

Yorkshire, all of which had been acquired by amalgamation in the early days of the Manchester, Sheffield and Lincolnshire Railway Company. There was considerable loss on the working of these canals, although the capital of them was represented by debenture stock of the Great Central Company, upon which interest had to be paid. The tolls charged on the canals for, roughly, 40 per cent of the traffic are below the maximum fixed by the act of 1894, these maximum tolls being very much less than the tolls payable previously. Up to 1892 the Great Central Company were carriers themselves upon the canals, but in that year carrying ceased, because it was found that taking expenditure all round the traffic could be worked cheaper by railway. The canals are open to anyone who will pay the tolls, and local carriers charge what they think proper in competition with the railway, the ruling factor of their charges being the railway rate. And this may be taken to apply generally. If the railway companies increased their railway rates there is no doubt that the canal carriers would follow with an increase in their charges. As showing that the railway rates control the canal rates and not the canal rates those of the railways, he instanced the Manchester Ship Canal rates, and said that no material change had been made in the rates between Manchester and Liverpool since the opening of the Manchester Ship Canal.

In 1847 the Sheffield Navigation, seeing the result of railway competition, themselves made a railway paralleling their canal for a distance of about 80 miles. In 1864 they allied themselves with the Manchester, Sheffield and Lincolnshire Company, and in 1874 an absolute transfer of the undertaking was made.

Upon the promotion of the Manchester Ship Canal there was an agitation in Sheffield for a similar canal from Sheffield to the Humber, via the Trent, and an act was obtained to transfer the canal from the railway company to a company promoted in Sheffield. Upon this being done, the new company could not find its capital, and after attempting to do so for six years, they suggested to the railway company that as much money as they could raise by the issue of preference stock should be paid to the railway company and the remainder of the purchase money taken in ordinary shares of the canal company. Accordingly, £600,000 was paid, and £540,000 ordinary shares were accepted by the railway company. The total amount represented the cost of the canal as it stood in the books of the old canal company, and in those of the Great Central Company. It is now suggested that the terms were onerous. Put briefly, the position from first to last has been: The traders of Sheffield and district made a canal, which, on the inception of railways, was rendered more or less useless. They turned themselves into a railway company, amalgamated themselves with the Great Central, then asked Parliament to be allowed to take back the canal, could not find the money, the railway company assisted them to find a portion, and now it was said that they were handicapped because of the arrangement, and wished something to be done to enable them to compete more energetically and effectually against the railway companies in the district.

He said the statements made by Mr. Bartholomew of the Aire and Calder Company were unfair and contrary to the fact. A feature of this case was that the Aire and Calder Company and the Sheffield and South Yorkshire Navigation had constructed a new connection

between them 5¾ miles long, which was opened last year. The estimated cost of this connection was £160,000, but it had cost £300,000 to complete, giving a fair example of what the improving of the existing canals and the making of new ones would mean in expenditure under modern conditions. He did not think there was any prospect of a very large coal traffic being sent by this canal to Goole; there were certain very definite reasons why such would not take place. It was no doubt to the advantage of the Aire and Calder Company to attract traffic to Goole, but it was distinctly contrary to the interests of the Sheffield and South Yorkshire Company that such traffic should be diverted from Hull.

Answering a complaint made by the Aire and Calder Company as to railways owning steamships and docks, Mr. Fay said that this came from rather a strange quarter, seeing that Mr. Bartholomew was the chairman of the Goole Steamship Company, who not very long since sold the whole of his fleet trading to and from Goole to the Lancashire and Yorkshire Railway Company; and it must be remembered that the Aire and Calder Company also own the port of Goole and the docks there. The Aire and Calder Company is precisely in the same position as a railway company as a trader, the only difference between them being that the traffic is hauled along a waterway instead of along a railway.

Docks, Mr. Fay said, are not as a rule well-paying properties, but the dock is as essential to a railway company at the seaboard as the station is inland, and Mr. Fay was quite sure that it is to the advantage of the trading community that railway companies should have their steamboats to and from the Continent. If they had not these boats the cross-channel services would not be maintained in such an efficient state, nor could the traders obtain information as to throughout charges from any part of the country as they do now. If there were a number of small steamship companies competing with one another for this traffic the services would probably be poor and uncertain or the merchandise would be carried in German or other ships. It is necessary that the cross-channel service should be conducted with as much regularity as the goods-train services are. It is undesirable in the interests of home trade that the railway companies should be hindered or prevented from dealing with traffic from all parts of the country to the Continent with due regularity and upon proper terms.

Mr. Fay said that canals had been hopelessly outclassed by railways from the inception of the latter. Railways are a far superior means of conveyance and distribution. Some of the reasons are: (1) That canals carry only between A and B or C, whereas railways carry from A to the rest of the alphabet and vice versa. Traders naturally prefer to deal with one carrier who can provide quick and reliable transport to and from all places. (2) A manufacturer who has a siding to his works can himself run railway wagons to any part of his manufactory, and has neither to lay out nor build his works to suit a fixed spot for the receipt and dispatch of goods as in the case of a canal. (3) There are more privately owned railway wagons in the country than there are railway-owned, and it is to the interests of owners to keep their wagons continuously running. This tells very much against canals. (4) The facilities given in railway trucks for the storage of coal. It is the practice at east-coast

ports for coal to be sent to the ports and kept in sidings awaiting a market, and there have been cases of such trucks remaining in the railway company's sidings for many months at a time. This would be quite impracticable in canal boats; the many thousands of trucks standing at the ports could not be accommodated in water space, nor could barges be moved about from one part to another upon a sale of the coal. (5) The greatest factor of all is, no doubt, that of speed. Almost everyone to-day lives from hand to mouth. The consumer, the retailer, the middleman, and the manufacturer all expect to send out orders by telephone or telegraph to-day and get delivery to-morrow. Even in coal traffic, some works are so circumstanced that they require a train load or two of coal each morning. This demand has brought about a service of goods trains on the British railways that is without an equal in any part of the world.

Comparing the Continent with England, Mr. Fay said, that to make up for a limited seaboard, Germany and other countries utilize their large and long rivers, and in this connection it must be remembered there are long distances to cover and a very much larger area than in these islands. The goods-train services, again, are not to be compared with those in Great Britain; probably there is not the demand for quick transit prevalent in this country. As a case in point, between Hamburg and Magdeburg, a distance of 156 miles, railway transit takes four days, and between Hamburg and Dresden, 288 miles, five days; Hamburg and Berlin, four days; the times by water being six, nine, and seven days, respectively. Between Rotterdam and Liege and Dusseldorf it takes four days for a distance of 130 miles, and to Ruhrort, 122 miles, the times occupied by water and rail are identical, namely, four days. Between Antwerp and Liege, 74 miles, the railway transit is two days.

The rates for the lower classes of traffic are in some instances higher and in some slightly lower by railway than by water. In the longer distances there is considerable advantage in the conveyance by water from the fact that in one direction the stream is made use of for power, and the bulk of the traffic is export. In the return direction the boat owners are glad to get freight of any sort. These conditions do not apply in England. There could be no greater proof of the superiority of the English goods-train services as compared with water than the volume of traffic which passes from one seaport or manufacturing center adjacent to the sea to another port. For instance, trains are sent daily with goods from Manchester and district to Southampton for shipment, and there are no less than five companies competing for this traffic, all of whom get the traffic into the docks by 8 o'clock in the morning after dispatch. Between the Great Central Company's own port of Grimsby and London there is a considerable traffic in merchandise of all sorts, and this in face of sea competition, which simply takes the residue. There is no question of tolls on the ocean, nor are there any wicked railway managers to upset or control the rates, yet the railway secures the bulk of the business.

Mr. Fay said it was not reasonable to compare the rates on the Continent, where the distances were long, with the short hauls in England. The fact of the matter was the British Islands were not big enough for canal systems like those on the Continent. Where the

distances were short on the Continent the difference in the charges as between railway and canal were not very great. If railway rates in England were too high it was clear that either better dividends ought to be paid by the railway companies or that railway managers did not know their business.

Mr. Fay said the railway company between Liverpool and Manchester was as well off now as before the Manchester Ship Canal was opened, but the position of the Manchester and Lancashire district was altogether exceptional, and the making of ship canals or large canals elsewhere was not likely to bring about such a result as in this case; and even that canal was not financially successful. He said it was better to take docks to the deep water than to bring deep water to the docks.

# VOLUME IV.

## SMALL CANALS OF LITTLE VALUE.

Mr. L. B. Wells, C. E., of Manchester, formerly connected with the Weaver Canal Navigation, said that the cost of carriage in England was higher than that abroad, and he considered it of the highest importance to trade that it should be reduced. Small canals were practically useless, unless as feeders to the large ones. In France the large canals carried from three-fourths to four-fifths of the traffic. The St. Helen's Canal, he said, had lost its coal traffic, and that on the Weaver had dwindled owing to works being better supplied by rail. Agricultural traffic on the Weaver was very small, but might be improved if farmers would combine. Canals to be effective must be as large as possible. The most important canal routes were those from the Midlands and to Liverpool. As regards connection between Liverpool and Bristol, he thought connection by sea better than any inland connection by waterway. With a depth of 8 feet, and allowing six locks per 10 miles and a proportionate number of bridges, the cost of a canal from the Midlands to Liverpool would be £21,000 per mile, and with a depth of 12 feet, £33,000. He did not think local authorities would be at all likely to contribute for the improvement of the canals.

## THE BIRMINGHAM CANAL.

Mr. G. R. Jebb, C. E., chief engineer of the Birmingham Canal Company since 1875 and of the Shropshire Union Railways and Canal Company since 1869, and chairman of the Upper Mersey Navigation Company, explained that both the Shropshire Union and Birmingham canals have been maintained in a high state of efficiency, and many improvements have been made in them during the last thirty years. The London and North-Western Railway Company guarantee certain dividends and have to provide large sums of money every year to fulfill their obligations in this respect. The chief cause preventing the carrying out of improvements by private enterprise was that capitalists were satisfied they would not get a fair return on the expenditures. He did not consider it desirable to expend the large sums necessary to effect any substantial improvement in existing waterways, as such expenditure would, in his judgment, be unremunerative. Any benefit the country would derive from improved waterways would be incompatible with a reasonable return on the cost.

The Birmingham Canal Company, about 1845, having a canal from Birmingham to Wolverhampton with a good deal of land alongside available for a railway, and foreseeing the competition of railways, and evidently to place themselves in a better condition to negotiate, proposed to make a railway themselves between these two towns in direct competition with their own canal and with the Grand Junction Railway. At the same time an independent company was projecting a railway between Birmingham, Wolverhampton, and Dudley, and this led to negotiations between the canal company and the railway companies. It was arranged that the canal company should contribute one-fourth of the cost of the construction of a railway between Birmingham and Wolverhampton, with a branch to Dudley and should sell the new company the necessary land. The shares received by the canal company in exchange for such subscription are represented by £126,725 ordinary stock of the London and North-Western Railway Company, which are still held by the canal company. In return, the London and Birmingham Railway Company guaranteed a dividend of £4 per annum on each share of the canal company's capital, which is what they were then paying. The act effecting this also vested the management of the canal company in a committee of ten, five to be nominated by the canal company and five by the railway company.

The Birmingham Canal system is a network of canals, chiefly in the mining district of South Staffordshire, but extending into Warwickshire and Worcestershire, and its character in many ways is unique. The canal company do not act as carriers. The total length is about 159 miles. The highest level is 511 feet above the sea and the lowest 209 feet. There are 216 locks, which on the main canals will accommodate boats 71 feet 6 inches in length and 7 feet in beam, carrying 30 to 35 tons. There are several tunnels, two of which have towing paths. In the others the boats are propelled by "legging," two men lying on the boat and stepping along the side walls of the tunnel. The cost of supplying water is probably greater than in any other canal, much of the water being pumped into the supplying reservoirs. In the last twenty years £60,000 have been expended in enlarging and remodeling the chief pumping stations. The cost of water supply per annum averages £11,000, not including interest on the first cost of works, rates, or depreciation.

### TRAFFIC.

The annual traffic on the canal is about 8,000,000 tons, or about two-ninths of the total traffic on all inland navigations of the country. One-half of this traffic is coal, four-fifths of which goes to works on the banks of the canal, an average distance of about 8 miles. The average toll of the coal is about 5.50d. per ton. The company has entered into agreements with other canal companies for through tolls on traffic to and from its system and the ports of London, Liverpool, Gloucester, Bristol, and Hull, and other cities and towns, and has agreed to reductions in the parliamentary tolls equal, roundly, to 45 per cent. Not more than 10 per cent of the requests for reductions have been refused. These concessions have not, as the traders assured the company would be the case, increased the traffic on the canal, but is greatly decreasing the company's revenue from tolls.

BIRMINGHAM COAL RATES.

The toll chargeable on coal into Birmingham from the Fazeley district is 1d. per ton per mile, subject to limitations imposed by statute in 1894, which fixes the maximum charge at 9d. per ton, irrespective of distance, if not conveyed over the Birmingham top level, and 9½d. if so conveyed. In 1879 these rates were 1s. 2d. and 1s. 4.34d., respectively. From 1879 to 1905 the amount carried has declined from 1,037,636 tons to 773,439 tons, notwithstanding the large increase in population. The average mileage of the Birmingham coal is 18 miles.

RAILWAY TRANSSHIPPING DEPOTS.

A large number of railway basins or places for the direct transshipment of goods from canal boats to railway trucks, and vice versa, have been made during the last twenty or thirty years. The multiplication of these railway basins is of great advantage to the public, but necessarily shortens the distance traffic passes along the canal, decreasing the tolls. These basins belong to the railway companies, who get the benefit of the canal as a feeder.

MANUFACTORIES ON THE CANAL.

Works of all descriptions have been built on the banks of the canal, and these form an almost continuous line for many miles between Birmingham, Wolverhampton, and other places. The erection of these works was encouraged in the early days of the canal by the grant of specially low tolls on coal and cinders going to works adjoining the canal. Moreover, these works have statutory powers to take water from the canal for condensing purposes for working steam engines, without payment. . Most of these works would have to close if the canal were stopped for more than a few days.

PHYSICAL CONDITION.

The canal has been much improved since 1875. It has been faced with brick walling for many miles; the waterway under many bridges has been doubled in width; it has been widened and deepened at many points, and the chief pumping stations have been remodeled. The cost of maintenance has increased from £36,445 in 1845 under the canal company to £99,227 in 1905 under the London and North-Western Railway Company. But for the large expenditures made from the funds of this company the canal could not have been carried on.

From 1846 to 1874 the canal company was able out of its own revenues to pay dividends of 4 per cent. In 1874 the London and North-Western Railway Company had to make up a deficiency of £10,528, and since then the annual deficiency has averaged nearly £22,500. The total amount the railway company has made up since 1868 is £685,266.

THE SHROPSHIRE UNION CANAL.

Mr. JEBB said that the arrangement between the Shropshire Union Canal and the London and North-Western Railway is very much on the same lines as in the case of the Birmingham Canal—namely, the

fear of railway competition and their desire to place themselves in the best position to negotiate with the newcomers by promoting railway lines of their own, not only in competition with their own canals, but attacking the railway companies. The first authorized railway was from Caverly in Cheshire to Wolverhampton, which would compete with the London and North-Western Railway, and was to have been constructed on the site of the canal; second, a railway from Shrewsbury to Stafford; and third, from Crewe to Newton. The only railway constructed under these powers was from Shrewsbury to Stafford. That portion between Shrewsbury and Wellington was constructed jointly by the Shropshire Union Railway and Canal Company and the Shrewsbury and Birmingham Railway Company, and is now under the joint control of the Great Western and London and North-Western companies. The line from Wellington to Stafford was constructed by the Shropshire Union Railway and Canal Company and is now managed by the London and North-Western Company under the lease. The powers obtained by the company of converting their canals into railways led to negotiations with the London and North-Western Railway Company, which ended in an agreement for leasing the undertaking of the Shropshire Union Company to the railway company in perpetuity.

The main canal is from Autherly, near Wolverhampton to Ellesmere Port, which abuts on the Manchester Ship Canal, with branches to Shrewsbury, Newtown, Llangollen, and Middlewich, and the total mileage of the system is 200 miles. The level of the canal at Autherly Junction is 341 feet above the sea. There are 135 locks. The locks between Autherly and Nantwich are only capable of passing a boat 72 feet in length by 7 in width, carrying about 25 tons. The locks between Nantwich and Ellesmere Port accommodate either a barge 14 feet wide or two 7 feet wide.

### BUSINESS AS CARRIERS.

The Shropshire Union Company, in addition to charging toll, act as general carriers. They have 328 horses for haulage on canals and 81 for cartage. In addition 94 horses are owned by steerers and the company hire largely for cartage. They also have an extensive fleet of steam tugs, flats, and canal boats. The chief articles carried are coal, iron ore, pig iron, bricks, china clay, grain, flour, iron and steel, timber, earthenware, hardware, sugar, and cheese. The canal company compete with the following railway companies: The North Staffordshire, the Cambrian, the Great Western, and also the London and North-Western. The chief articles conveyed over the system by bye-traders are: Grain, coal, iron, sand, and bricks. The Shropshire Union Canal passes through a sparsely settled district and there are no large works or manufactories on the system. Some years ago a large traffic in limestone from the Llanymynech and Llangollen districts, amounting to about 10,000 tons a year, for delivery to blast furnaces in South Staffordshire, but as nearly all these works now have siding accommodations, the traffic has left the canal, and although the canal company only charged a toll of 6d. per ton for the use of 80 miles of their waterway, none of the traffic is now passing.

IMPROVEMENTS.

During the last thirty-five years large sums have been expended in providing additional accommodation and facilities at various points. At Ellesmere Port alone the expenditure has been about £263,000, which works could not have been carried out had not the London and North-Western provided the money. Deep-water quays 1,800 feet in length, abutting on the Manchester Ship Canal have been built; also a large grain warehouse costing £80,000. An excellent system of hydraulic cranes has been provided. The Shropshire Company are carriers between Ellesmere Port and the large towns in the North Staffordshire potteries. In these towns during the past thirty years very large sums have been expended in building warehouses and wharves for pottery materials, and these facilities have afforded great encouragement to the traffic.

LOSS ON WORKING.

Although the public have benefited by these increased facilities, the receipts have not increased proportionately. Since 1885 the London and North-Western Railway Company have had to contribute £1,022,948 in order to pay the guaranteed dividend to the Shropshire Union Company's shareholders.

PROPOSED NEW CANALS.

With regard to the proposal to make new and improved canals between the Midlands and the ports of Liverpool, Bristol, London, and Hull, witness stated that he believed it is generally admitted that unless the Birmingham Canal system can be used as a feeder to the new canals, that they would be of little use. The canal at Birmingham is 453 feet above sea level, and witness is satisfied it would be quite impossible to pass along the existing Birmingham Canal such an additional amount of traffic as would be necessary to justify the making of the proposed new canals. He believes that any substantial increase on the present traffic (apart from the block at the locks) would cause serious obstruction and delay at several points on the canal, especially at Wolverhampton. Over 80 per cent of existing traffic is local and does not go off that system, and so would continue to occupy the waterway if new canals were made.

One of the chief difficulties lies in the fact that the outlets to the Birmingham Canal system to the proposed new canals would necessarily be down two long flights of locks at Wolverhampton and Birmingham. There is congestion at the Wolverhampton locks at certain periods of the day so that a dozen boats are often seen awaiting their turn to enter.

IMPRACTICABILITY OF WIDENING BIRMINGHAM CANAL.

It is absolutely impracticable to either widen or deepen the main routes of this canal. The destruction of property, chiefly works, would be enormous. The widening of the canal would destroy the traffic which it is proposed should feed the new canals. In many cases, too, railways run close to the canal, and would be seriously interfered with by any widening.

### COST OF PROPOSED CANALS.

The cost of widening, deepening, and improving the existing Shropshire Union Canal between Autherly Junction and Waverton, making a new canal between Waverton and Stoke and widening the Shropshire Union Canal between Stoke and Ellesmere Port to the dimensions suggested by Mr. Saner, would be £3,279,220, or £52,258 per mile; or, according to the scheme of Mr. Morton, £2,544,953, equal to £40,557 per mile. It would require about nine times the present traffic at existing tolls to pay 3½ per cent interest on the cost according to the first scheme; or seven and a half times according to the second scheme.

The necessary increases in water supply present serious difficulties. The traffic in winter would be always liable to be stopped or seriously interfered with by frost.

Should the canal be taken over by the State or a trust it would be necessary to add to the estimates for improvement the value of the existing canals and works, and also a large sum for loss incurred by the canal company and by traders by the closing of the canals during improvements. The new canal would be of very little use unless the Birmingham Canal were enlarged, which is impracticable, as stated.

### SUBSIDIZING CANALS.

When acts of Parliament for making railways were being applied for, about 1845, Parliament in many cases compelled railways to take over the competing canals and guarantee them a certain income. It would be manifestly unjust that Parliament should now authorize public money to be expended for improving any of these or other canals competing for traffic between any two places unless the owners of the canals were fully compensated and also relieved from all obligations in respect of them and exempted from contributing toward the making up of any loss which might be incurred in working the improved canals. Where there is more than one canal route between two points, if one canal were greatly improved the others might be ruined; and it would be unfair to other ports to make an improved canal to one port only. The improved canals would substantially benefit only a limited class, viz, certain traders. The general public would have to be taxed to make up the loss which would certainly be made if the state bought the canals, improved and worked them. Manufacturers are more and more disinclined to erect works on the banks of canals unless railway accommodation is also to be obtained.

### CAUSE OF DECLINE.

One undoubted cause of the great decrease on the canals is the hand-to-mouth system of the trade to-day as compared to what it was in the old canal days. Then the trader used to buy large quantities; to-day he often orders his goods in small consignments, by telephone or telegraph, as he wants them, and is ever pressing the railways for rapid deliveries. Canals often lose traffic to railways whose rates are higher because the latter can deliver quicker. Larger boats would have to wait for full cargoes. With regard to coal traffic, it is a much simpler matter, and cheaper, to run a railway truck to a coal

tip and discharge direct into a seagoing vessel or into a cart on a wharf than to transship or unload coal from a barge. Railways carrying coal from South Staffordshire have sidings into most of the collieries and carry direct to where the coal is wanted.

### COST OF TRANSPORT BY RAIL AND CANAL.

The comparative cost of conveying goods by railway and canal from works to a port is a complex matter to estimate. The cost of mere haulage of given weight for a mile on a railway on a level or on a canal without locks is of no practical use. The cost would depend, among other things, on—

By rail: Whether the goods are conveyed in train loads; length of run; description of locomotive; gradients.

By canal: Size of vessel; section of canal; motive power; number of boats; time lost in waiting to load and unload.

By either rail or canal: Unavoidable delays on journey; terminal facilities for loading and unloading; whether there is back loading, and to what extent and to what places.

If it should be decided that the canals are to be taken out of the hands of existing proprietors, it would be better to empower a trust or trusts to acquire the canals on reasonable terms and to improve them than that the state or borough or county councils should do so at the expense of those who believed they would be injured thereby.

### BRITISH AND FOREIGN CANALS.

English and foreign canals can not fairly be compared. On the former the haulage is short, the contour of the country is most unsuited to canals, requiring many locks, consignments are small, there are many ports, and there is great difficulty and expense in supplying water. On the latter the traffic is generally conveyed long distances, many of the waterways are improved rivers, the canals have few locks, there are few ports, and there is plenty of water. On English canals canal carrying companies are bound by act of Parliament not to charge more than certain maximum rates or tolls and to charge all parties alike for similar services. The carriers on foreign canals are entirely free from any control by the state in regard to either the services rendered or the charges made. Witness has read practically all the evidence, and however much one witness in favor of canals may differ from another they all agree that the public can not be depended upon to find the money for desired improvements without a guaranty from the state or county councils. Surely this is an admission that far-seeing business men feel that the investment would be an unsound one. Witnesses urge that the state should take a risk which business men will not.

### GREAT WESTERN RAILWAY CANALS.

Mr. W. W. Grierson, engineer of the Great Western Railway Company, said that that company owns 182 miles of canals and 30 miles of river navigations, including the following: Kennet and Avon Navigations, River Kennet Navigation, Kennet and Avon Canal, River

Avon Navigation, Bridgewater and Taunton Canal, River Tone Navigation, Grand Western Canal, Stover Canal, Stratford-on-Avon Canal, Stourbridge Extension Canal, Monmouthshire Canal, Brecon Canal, Swansea Canal. The maintenance of the Kennet and Avon Navigations, Stratford-on-Avon Canal, Stourbridge Extension Canal, Monmouthshire Canal, Brecon Canal, and Swansea Canal is effected by a canal engineer and staff appointed for that purpose, whose offices are at Bath. As to the Bridgewater and Taunton Canal, the River Tone Navigation, and the Grand Western Canal, it is effected by the engineer controlling the Plymouth division of the Great Western Railway, whose offices are at Plymouth. The canal engineer and divisional engineer referred to are both responsible to the Great Western Company's engineer for the proper upkeep of the canals in their charge. All the canals and navigations are maintained in fair working condition fit to cope with a larger volume of traffic than they now have, subject to the following exceptions: The upper end of the Swansea Canal, 3 miles in length, has been allowed to fall into disuse. A portion of the Stover Canal about a mile in length fell into disuse about 1870 on the closing of quarries which afforded the only traffic. There is no shortage of water except when the rivers are low, and inconveniences from this source are rare. The company have on each of their canals one or more dredgers, except on the Stourbridge, where none is needed, and work to secure a sufficient depth of water to meet all requirements of traffic unless at exceptional seasons. The works generally are maintained in fair working order. The cost of maintenance and expenses incurred by traffic department have during the last ten years exceeded the total receipts to an average annual extent of £7,168.

### DISADVANTAGES OF CANALS.

Canals such as those owned by the Great Western Railway Company were unable to compete with the railways, and this was recognized by their former owners. The Monmouthshire Canal became part of a railway system when the proprietors of the undertaking converted themselves into a railway company by constructing a railway parallel to their own canal.

The first cost of the Brecon and Abergavenny Canal was £135,450; and the canal passed into the hands of the Monmouthshire Railway and Canal Company at a cost of £61,861. At that time two independent railways between Brecon and Abergavenny were being promoted, and the canal proprietors approached the Monmouthshire Railway and Canal Company with a view to a sale of their property. That company had an interest in the canal being kept open, because their Monmouthshire Canal was largely dependent for its supply of water on the Brecon Canal. Possibly, also, they hoped that once owners of the Brecon Canal they might be able to compete against either of the two railways under promotion and possibly also against the Brecon and Merthyr Railway, which had just been opened.

The Grand Western Canal, which cost £324,250 to construct, passed into the hands of the Bristol and Exeter Railway Company at a cost of £30,640, the transfer being due to the construction of the Bristol and Exeter line between Taunton and Tiverton in 1848. The effect of the construction of that railway was to transfer, in a very few

years, practically the whole of the traffic from the canal to the railway.

The Bridgewater and Taunton Canal, 14½ miles in length, including the docks at Bridgewater, which must have entailed a very large sum to construct, passed into the hands of the Bristol and Exeter Railway Company in 1866 at a cost of £74,012. That railway was opened in sections between 1841 and 1844, with the immediate effect of lessening the canal receipts and ultimately to such an extent that the canal company were unable to pay their mortgage interest, which led to the sale.

The Stourbridge Extension Canal, which cost to construct £49,000, passed in 1846 into the hands of the Oxford, Worcester and Wolverhampton Railway Company at a price of £49,437. The purchase was due to the promotion in Parliament in 1845 of that railway, a bill which was hotly opposed by the canal company. A compromise was effected in committee by which the proposed railway company became the owners of the canal at cost price.

The Stratford-on-Avon Canal, which cost £413,204 to construct, passed into the hands of the same railroad at a cost of £173,322. The promotion of the railway was strongly opposed by this canal company, which led to an agreement of sale to the railway company at less than half the cost of the canal.

The Kennet and Avon Canal and Navigations, which cost £1,072,000 to construct, passed into the hands of the Great Western Railway Company in 1852 at a cost of £210,415. The traffic on the canal decreased steadily from the year 1841, which was the opening year of the Great Western Railway between Reading and Bristol; and in 1846 the canal company, no doubt with the object of forcing the railway company to purchase their undertaking, sought, but without success, Parliamentary powers to construct a railway alongside their own canal. The canal was further prejudicially affected by the opening in 1848 of the Chippenham and Trowbridge Railway, and the result was that under agreement the proprietors transferred their canal to the Great Western Railway Company in 1851 at about one-fifth of the original cost of construction.

The Swansea Canal is another instance of the inability of a railway-owned canal to compete against a rival railway company. This canal was constructed in 1800, connects with the docks at Swansea, and passes up the valley of the River Tawe, serving en route Morrison, Clydach, Ystalyfera, and the district up to Abercrave, a distance of 16 miles. From a point about 14 miles from Swansea downward the canal formerly served a large number of works and was in a prosperous condition in 1872, when, due to the promotion of the Morrison Branch of the Great Western Railway, negotiations ensued which led to the purchase of the canal by that company. The opening of the railway in 1881 naturally affected the canal receipts, but the canal continued to make a good revenue return till the Midland Railway commenced to construct branch sidings from their Swansea Valley Railway to the yards of the various works alongside the canal, with the result that the traffic passed from the canal to the railway. At two points the Midland Railway now crosses the canal and takes the traffic from works formerly served by the canal. At three points the Midland Railway have constructed branches crossing the river

Tawe and take the traffic from works served by and built on the banks of the canal. Private tramways cross the canal and convey coal to the Midland Railway from two collieries. One colliery and an iron mill have removed their sidings to the canal and empty their skips into Midland Railway trucks. It must be perfectly clear that the Great Western Railway Company could have no other interest except to retain in their own hands traffic from the various works referred to, but they have been unable to do so in the face of the competition by a rival railway company. The traffic has gradually fallen year by year as the Midland Company have extended their feelers, with the result that in 1905, for the first time, the expenditure exceeded the receipts. The value of the whole of the traffic during the year 1906 was £1,182, whereas the expenditure was £2,723.

### THE BRIDGEWATER AND TAUNTON CANAL.

The Bridgewater and Taunton Canal is cited as an instance indicating that where coal can be conveyed direct by rail from pit's mouth to destination, water carriage necessitating transshipment from truck to ship and from ship to barge can not compete. In the year 1880 the tonnage of coal carried on the canal amounted to 17,072 tons; in 1886 the Severn Tunnel was opened, and the tonnage fell in 1890 to 7,140 tons; in 1900 it was 3,275 tons, and in 1905 it was 320 tons.

In connection with the same canal witness mentioned that between the years 1896 and 1901 claims amounting in all to £436 were made against the railway company on the ground that difficulty had been experienced in navigation, due to insufficient water. No doubt some ground existed for these complaints at times of drought, and in consequence steps were taken to increase the pumping power. The claims in question were met by the company arranging to temporarily carry the traffic by railway at the same rates as were payable by canal, and in addition to pay the cost haulage to and from the railway. In 1902 all ground for complaint had been removed, but the firms which originally made the complaints continue to send their traffic by rail, paying full railway rates and cost of carting to and from the railway.

### THAMES AND SEVERN CANAL.

The Great Western Railway acquired an interest in the Thames and Severn Canal in 1882 by the purchase of shares and mortgages. The canal was opened originally in 1799, and, as stated in Sir John Dorrington's evidence, was successful until the opening of the Great Western Railway in 1841, but paid no dividend after the year 1873. In 1901 the canal passed into the hands of a public trust, but, as admitted by Sir John Dorrington, with very disappointing results.

The Somerset Coal Canal and the Wilts and Berks Canal, both of which were at one time directly connected with the Kennet and Avon Canal, and both of which—owned by private companies—have become derelict, whereas the railway-owned canal, the Kennet and Avon, has been maintained in working order at a very heavy annual loss.

On the river Kennet Navigation the want of water in summer is due to the drawing off by mill owners who have superior statutory rights.

On the Kennet and Avon Navigation it has always been necessary at certain seasons of the year to limit the load on canal boats, on the western section. During the year 1906 loads of over 50 tons were conveyed on the canal during the winter, but were reduced in summer to 25 tons on a portion of the canal. The quantity dredged on the Kennet and Avon Canal during the last ten years amounts to 210,000 cubic yards. The Somerset Coal Canal became derelict before the Great Western Company acquired powers to construct a light railway. Coal, if brought to London by means of the Kennet and Avon Canal, would have to be transshipped at Avonmouth or Bristol, and the experience of the Bridgewater and Taunton Canal, before referred to, where circumstances would be similar, indicates the improbability of coal being diverted into this channel.

### GENERAL VIEWS ON CANALS.

All the canals and navigations owned by the Great Western Railway are in fair working order, but in every case the expenditure exceeds the receipts, with the exception of the Stover Canal, which latter is leased to a private firm. The causes which have operated to prevent improvements by private enterprise are undoubtedly due to the prospect of more or less direct loss on any outlay. Through communication now exists as between London and Bristol via the Kennet and Avon Navigations, but no through traffic passes. There is not even a remote possibility of any return on money expended in improving any of the canals owned by the Great Western Railway, and the trade of the country, or even of the localities directly served, would hardly benefit thereby. There is no objection, so far as railway companies generally are concerned, to canals being made or acquired by public bodies, provided that canals so acquired be not converted into railways or subsidized by government or local rates to compete against railways.

Mr. T. H. Rendell, chief goods manager of the Great Western Railway Company, said the Bridgewater Canal had shared the fate of many canals which had been taken over by railways, and in 1905 there was a loss in working of over £2,700; and on the Kennet and Avon of £6,500. Most of the canals owned by the Great Western were short, not forming parts of any through route.

### ENGLISH AND FOREIGN CANALS.

Mr. Rendell said there were great differences in circumstances on the Continent and in England. On the Continent the railways and waterways are either state owned or subsidized, and the State therefore has a hand in regulating the traffic and naturally desires to keep down capital expenditure on the railways, while the splendid natural waterways they possess can be used for transport. There were great advantages on the Continent in the matter of levels, the wide natural waterways penetrating inland great distances, the smallness of the seaboard, and the greater distance it is from inland centers, as compared with England, and the concentration of traffic at one port.

ENGLISH RAILWAY RATES.

Witnesses had stated that English railway rates were high; and the Birmingham corporation had passed a resolution that to provide healthy competition the State should step in and out of public funds provide means for competing with private enterprises. Comparisons of rates in England and on the Continent are misleading unless circumstances are identical; for example, rates on the Continent simply cover the service of haulage from one station to the other, and do not include collection and delivery, loading or unloading, and are further affected by state ownership. Witness denied that where the circumstances were alike the rates in England generally were higher than those in other countries, and referred to one or two independent writers to prove this: Mr. Acworth on "Railway Rates;" Mr. Pratt, "Railways and their Rates;" Sir George Gibb, Railway News, May 14, 1904.

Not only do France, Belgium, and Germany protect their home industries by customs duty, but they also aid them by the granting of exceptional rates for export traffic and for such raw material as does not compete with their own products. To make a fair comparison with foreign rates there must be added to the latter the charges of the "lumping agents." In America the proportion of the charges on small consignments included in the railway company's receipts would only be the 40 per cent of the charges made to the public paid to them by the express companies who retain the balance for their own services. In France the country is divided between the few large companies, who are thus not in opposition, and are consequently saved an enormous expense such as is incurred in England for parliamentary purposes, and, in addition, the railways are subsidized by the State. A canal would serve only the immediate country through which it passes, whereas a railway serves the country beyond by branch lines. If a widened canal were made from London to Liverpool, owing to the delay in transferring the goods from barge to railway truck, it would be of no value to the southern and northern counties or to Scotland, whereas the ramifications of the railways are such that there are through connections all over the Kingdom.

Mr. Rendell doubted whether there were many traders dealing with consignments of 200 or 300 tons. His experience with the large iron and steel works in South Staffordshire showed that for a period of six months there was not forwarded a single consignment of over 200 tons, and only five between 100 and 200.

Previous witness had generally agreed that any advantages to be obtained in the way of cheapening of rates would be largely discounted unless the canals can be brought alongside the works. The area, therefore, to be utilized for the erection of works would, to a great extent, be limited to land on the banks of the canal, and this would be further limited to locations near large towns to furnish laborers.

Mr. Rendell agreed with the general trend of the evidence that canals would be of little good to agriculturists.

Witness referred to the rapid growth in taxes paid by railway companies, which have increased by 141 per cent in eighteen years,

and thought it would be unfair that canals should be made by municipal aid to compete with railways, seeing that the railways themselves would be taxed for the purpose.

Witness is of opinion, should it be decided that benefit would arise to all or certain sections of trade by lessening the cost of transport, that, having regard to (1) the condition under which trade is conducted in England, i. e., its retail nature, and the demand for quick transit; and (2) the fact that the widening of canals as suggested by Mr. Saner, and the difficulty of supplying water, would make the improvements very costly, there would be no likelihood of a reasonable return on the cost, and that it would be more economical to the State to subsidize railways as is done in foreign countries.

### THE ASHBY CANAL.

Mr. Guy Granet, general manager of the Midland Railway Company, gave evidence in regard to the Ashby and Cromford canals, owned by that company, and having a total mileage of 46 miles. The Ashby Canal was authorized by act of Parliament in 1794. The canal joins the Coventry Canal at Marston, in the county of Warwick, passes through Stoke Golding Market, Bosworth, Shackerstone, and Measham and terminates at Moira. The canal, 30 miles in length, was opened in May, 1905. In 1846 the Midland Company obtained an act for the construction of a railway from Burton-on-Trent to Nuneaton, with certain branches. The line between Moira and Nuneaton was practically alongside the canal for the whole distance. The preamble of the act states that whereas the construction of the proposed railway would be detrimental to the interests of the canal, and would, in some respects, render the canal or parts thereof comparatively useless in the hands of the then owning company, but as the canal might be worked advantageously in connection with the railway, and as the canal company are prepared to sell, the Midland Railway had agreed to buy. Obligation was put upon the Midland Company to maintain, repair, and support the canal, with the proviso that if the Midland Company fail to do this the Coventry Coal Navigation can repair and maintain the canal at the cost of the Midland Company. The enforcing of the maximum charges was subject to the condition that under no circumstances shall the charges by water exceed those by rail. Tolls were reduced in 1846, and again in 1894. There is one tunnel 250 yards long on the canal. There are no locks.

Barges on the canal average 70 to 80 feet long and 7 to 8 feet wide, carrying 30 to 40 tons. There is through water communication from the Ashby Canal to Coventry, Oxford, and London, etc., via the Coventry, Oxford, and Grand Junction canals; to Birmingham and the Potteries, via the Coventry and Birmingham canals. Barges using the navigation mostly belong to boat carriers, although there are a few belonging to traders. The number of barges on the canal is not more than five or six, loaded, with a similar number of empties. The capital of the canal stands in the company's books at £109,850. The average annual cost of maintenance for the five years ending in 1905 was £1,238. Receipts from tolls in 1905 were £964. On that year's workings, without taking into account the capital, the loss was £397.

COLLIERIES PREFER RAILWAY.

The Measham Colliery is a small pit situated on the canal, which up to 1902 had no connection with the railway. Direct siding communication was given in that year. During the year, before the sidings were put in, they put onto the canal 15,519 tons; in the following year, 9,129 tons; the next year, 6,372 tons; the next, 7,990; and the next, 7,090. On the other hand, their rail-borne traffic, which amounted in 1902 to 8,705 tons, increased in 1903 to 29,033 tons.

Mr. Gordon Thomas in his evidence states that "the Ashby Canal, of course, should be a very big feeder of traffic indeed to the Grand Junction system, but by reason of the reduced sectional area and the difficulty boats have of navigating upon that canal there is very small traffic indeed coming from the collieries situated on that canal." The Midland Company has kept the canal properly maintained since they came into possession of it; they, of course, have nothing to do with the width of the canal, which was constructed nearly fifty years before they bought it. There is no difficulty in boats navigating the waterway, assuming they are of suitable dimensions to work on the canal as originally constructed.

THE CROMFORD CANAL.

The Cromford Canal was authorized by act of 1789. In 1846 an act was passed for the construction of a railway from a junction at Cheadle, in Cheshire, with the Birmingham and Manchester Railway to connect with the Midland Railway at Ambergate, and power was given to the Matlock Railway Company to purchase the Cromford Canal, the clause stating that the railway authorized to be constructed by this act will cross and communicate with the canal, and that it would be of great public convenience if the canal and railway were placed under the same control and management. In the same year an act was passed authorizing the sale of the Cromford Canal to the Manchester, Buxton, Matlock and Midland Junction Railway Company, the price paid being £93,500 plus the obligation of certain morigages, and the tolls authorized by the canal acts were repealed, and in lieu modified tolls were scheduled. The company was required to keep open the canal in good repair and preserve the water supplies, with power to the board of trade to hold inquiries in case of complaint. In 1851 the railway company was authorized to raise additional capital for the completion of the purchase of the canal. In 1852 the company was authorized to lease to the Midland and London and North-Western Railway companies. In 1870 the Midland Company was authorized to acquire the undertaking of the Manchester, Buxton, Matlock and Midland Junction Railway Company, including the Cromford Canal. By act of 1894 tolls and other charges to be made on the Cromford Canal were reduced.

The canal commences at Cromford in the county of Derby, and proceeds by Whatstandwell, Ambergate, Butterly, and Condor Park, and terminates by a junction with the Erewash Canal at Langley Mill in Nottinghamshire. It joins with the Nottingham Canal, which is leased to the Great Northern Railway Company. The length of the main canal is 14 miles, which, with the cut to Pinxton, makes the total mileage 16 miles. There are four tunnels on the main canal

and fourteen locks. For a distance of 8½ miles between Butterly and Cromford the canal will not admit boats exceeding 7 feet in width. From Butterly Tunnel to Langley Mill boats up to 14 feet in width can use it. Boats using the waterway are about 70 feet long. Narrow barges carry up to 30 tons and wide ones up to 50. The company has no barges of its own, the boats being owned by traders and trade carriers. The average number of loaded barge journeys in both directions is about 6 or 7 a day. There is through water communication between the Cromford Canal and Loughboro', Leicester, London, etc., via the Erewash Canal, Leicester Navigation, and the Grand Junction Canal; to Nottingham via the Nottingham Canal; to Derby via the Erewash and Derby Canal; and to Birmingham and the Potteries via the Erewash, Trent and Mersey, and Birmingham canals. The Midland Railway runs along the canal for the whole of its length; and between Pinxton and Langley Mills the Great Northern line also runs parallel with the canal. Traffic on the canal to-day consists principally of coal, with some pig lead and bricks. In 1905 the cost of maintenance was £1,785. Total receipts were £875. On this year's working, therefore, without taking into account the capital cost, the loss was £910.

Owing to coal workings under the Butterly Tunnel the company has for years experienced great difficulty in keeping up the waterway, the tunnel subsiding from time to time and being repaired at great cost. The waterway, except for temporary stoppages, was kept open up to 1889. In that year the tunnel sustained serious damage and was closed up to 1893. In 1900 it again collapsed, and the large estimate of cost of repair induced the directors to refrain from making them, and since that year the tunnel has not been used. The blockage of the tunnel has impeded the flow of water from the portion of the canal west of the tunnel to the portion east of it. This has caused a shortage of water on the easterly portion to the detriment of navigation. The company tried to minimize this difficulty by adopting special pumping measures to force the water through and were successful for a time. A recent collapse has rendered it very doubtful whether any appreciable amount of water can be forced through the tunnel hereafter, and the company is now seeking an act permitting a supply of water to the eastern part of the canal from other conduits from the western to the eastern section. Twelve petitions have been presented remonstrating against such powers being granted, one representing 42 traders and associations and one representing 6 canal companies. Every one of these petitions calls attention to the shortage of water in the eastern end of the canal and urges the importance of a proper supply. The Midland Company is convinced that an improved supply is necessary in the public interests. If the powers sought are obtained, the works will be carried out at the earliest possible moment, and the company is prepared to come under obligation to complete them in eighteen months. The expense involved is great. Records of weight of traffic prior to 1893 can not be found. With regard to the exchange of traffic betwen the canal and the London and North-Western Railway at High Peak Junction, Cromford, records show that since the tunnel has been closed a greater amount of traffic has been exchanged with the railway.

As to the inconvenience to the public through the closing of the Butterley Tunnel, witness considered that no case can be made. Particulars of the traffic using the canal prove conclusively that nowadays there is no real public requirement for water navigation, so far as this canal is concerned, nor can it be alleged properly that the closing of the tunnel has caused any appreciable diminution in the weight of traffic using the canal. Present-day trading involves quick transit. Traders, especially coal merchants, do not keep anything like the stocks they used to, but now live practically from hand to mouth, ordering by telegraph or telephone; and while freight by canal may be cheaper than by rail, the fact of quicker transit, the necessity of having small consignments, the facilities afforded by having siding communication direct to the greater works, the depots close to the centers of communities where the coal is consumed, make it imperative for a trader who would do a prosperous business to avail himself of railway as against canal transit. Assuming, however, that the opposite was the fact, and that the Cromford Canal was largely used, it could not be alleged that the closing of the Butterley Tunnel had to any appreciable extent affected the flow of through traffic to other canals. At its northerly end the canal is dead-ended. It is true that there is a facility for sending traffic to stations farther north by means of the London and North-Western Company's High Peak Railway, but the closing of the tunnel had had no bad effect on the traffic so exchanged, but, on the contrary, a larger weight had been so dealt with since the tunnel was closed. It is obvious, however, that the closing of the tunnel has cut off for the purposes of through traffic the western portion for a distance of 8¼ miles. The firms using this portion, however, are very few, there being only eight private wharves thereon.

In 1899 by far the greater portion of the traffic using the canal was coal from the collieries on the east side to the wharves at the top of the canal. No hardship, however, from a public point of view, is occasioned by a stoppage of the flow of this traffic, as there are collieries on the west side of the tunnel using the water, and, as a matter of fact, the coal, or part of it, which used to come through the tunnel to the wharves in question is now being drawn from these pits. The only real result therefore in this case of the tunnel being closed is the transference from one set of collieries to the other of a particular trade to particular wharves. The only traffic from the west to the east which passed on to the Nottingham or Erewash canal in the year 1899 was 665 tons of stone. This traffic can not now of course use the water, as from the quarry, and while that is to be regretted, it can not be held that this is sufficient justification for asking the company to reinstate the tunnel.

Suggestions that the Midland Company have made it their business, by keeping the canal in bad repair, to starve the canal of its legitimate traffic are unwarranted. The canal has been kept in good repair, with the exception of the Butterley Tunnel, which has been injured through causes over which the company had no control, and so far as the company have had water available, it has fulfilled its obligations in this respect. It is quite true that in abnormally dry seasons there has been a shortage of water, and apart from the fact that this shortage to some extent was brought about by the block in the Butterley Tunnel, this has arisen through causes over which the

company had no control, and was not peculiar to the Cromford Canal only, as most canals suffered more or less in a similar manner. No complaint could possibly lie against the company of preventing the use of the canal by anyone, because, subject to their paying the tolls which Parliament authorized, the waterway is free for anyone to make use of. The statement of Mr. Thomas, chief engineer of the Grand Junction Canal, that the Cromford Canal is practically derelict, and for a large part of the year boats can not navigate the canal with even 8 or 10 tons, is untrue. The canal, with the exception of the tunnel, is well maintained, and the average load of the narrow barges using the water is from 20 to 25 tons, and on the east, where wide barges are used, the average is 40 to 45 tons. On the west side of the tunnel there are only eight private wharves, while on the east side there are ten. The Midland Company have for their own purposes a general wharf at Cromford; and the London and North-Western have one for their High Peak Railway.

### THE IRON TRADE.

Mr. J. S. Jeans, secretary of the British Iron Trade Association, whose headquarters are in London, said the object of the association was to promote the general commercial interests of the iron and steel interests of the country as a whole. Only a small part of the industry is served by canals, the chief centers of industry being Cleveland, Scotland, and South Wales. The majority of the works were near the sea, and on the whole, railway rates were not unreasonable. In the Cleveland district most of the works were near the sea and were served by the Tyne and Wear. The South Staffordshire iron trade could not exist without canals, and better communication with the coast was much needed. The association held that it should be the duty of the state to see that the commercial and industrial development of the country should not be hindered or prejudiced by anything that the Government had done, or that was in its power to remedy. If railway rates were a hindrance, that difficulty should be gotten rid of. Canals should be worked independently of railways. His association favored the project of four canals connecting the four chief ports of London, Hull, Bristol, and Liverpool. Really effective competition of canals against railways would promote the prosperity of the iron and steel trade in the Midlands. In some cases canal rates were not under railway rates.

### THE GREAT NORTHERN RAILWAY'S CASE.

Mr. Oliver R. H. Bury, general manager of the Great Northern Railway, spoke of canals leased to that company. The Fossdyke Navigation extends from River Trent to High Bridge, Lincoln, 11 miles. It was a canal of Roman construction which fell into decay; was restored in the reign of Henry I, fell into decay, and was again restored in 1670 and handed over to the Lincoln Corporation for maintenance; leased by the corporation to Mr. Richard Ellison and his heirs, and in 1856 subleased by the heirs to the Great Northern Railway Company and by that company to the Great Northern and Great Eastern Joint Railway Committee in 1882.

The Witham Navigation, 31 miles long, extends from Lincoln to Boston. It is a natural stream joining a tidal channel and falling into the Wash. In 1762 and 1812 acts of Parliament were obtained and commissions formed for restoring and maintaining the navigation, and in 1846 it was leased to the Great Northern Company for 999 years.

The Nottingham Canal runs from the Cromford Canal at Langley Mill to the River Trent at Nottingham, a length of 15 miles. Constructed by the proprietors under an act of 1792, and purchased by the Ambergate, Nottingham and Boston and Eastern Junction Railway Company under that company's act of incorporation of 1846, and subsequently leased by the latter company to the Great Northern Railway Company for 999 years from 1861.

The Grantham Canal runs from Grantham to the River Trent at Nottingham, 33 miles. It was constructed by the proprietors under act of 1793, and purchased by the Ambergate, Nottingham and Boston and Eastern Junction Railway under that company's act of incorporation of 1846, and to the Great Northern Company for 999 years from the 1st August, 1861.

### EARLY HISTORY OF THE CANALS.

The four waterways referred to all come under railway control by acts of Parliament passed in 1846. The original bargains with the proprietors were not made by the Great Northern Company, but by other companies whose undertakings they afterwards absorbed, and there is no doubt that the reason for these canals becoming railway owned was the policy generally pursued by canal companies at that time by which they forced the promoters of competing lines of railway to acquire their undertakings as the price of overcoming their opposition. In 1857 the chairman of the Great Northern Company, in replying to some criticism on the result of leasing the Witham and Fossdyke navigations, stated "the Great Northern Railway act (i. e., the act of incorporation) would have run great risk of not being carried at all if the directors had not adopted these bargains with the navigations, which were originally made by the promoters of another company." The other railway company referred to was the Wakefield, Lincoln and Boston, the promoters of which in 1844 in order to disarm opposition to their projected line—which was to be parallel with the waterway—arranged an amalgamation with the Witham and Fossdyke navigations by guaranteeing to the proprietors an assured income for the future, and the navigations provided free the land on which some 40 miles of the railway to Lincoln and Boston is laid. The promoters of the said Wakefield, Lincoln and Boston Railway subsequently merged their interests with those of the promoters of the London and York Railway, and eventually the Great Northern Railway act of incorporation of 1846 was passed. In this act powers were obtained for the leasing of the Fossdyke navigation from the original lessee for 894 years and of the Witham navigation for 999 years. The terms arranged were a rent of £9,570 a year for the Fossdyke and £10,545 a year for the Witham, which was the average of the navigation companies' net income for the three preceding years plus 5 per cent. The railway company had, further, in the case of the Witham, to assume liability for the payment of interest on vari-

ous mortgages, amounting to £24,962, which have since been redeemed by the Great Northern. The act places upon the Great Northern the obligation at all times during the lease (whether there is traffic or not) of maintaining the navigations with a navigable channel of not less than 5 feet in depth, "except only while prevented by drought or some other unforeseen and unavoidable cause."

The Nottingham Canal Company was incorporated in 1792 and the Grantham Canal Company in 1793, the capital of each being £75,000. The terms of purchase given by the Nottingham and Grantham Railway were £112,500 to the Nottingham Canal Company, and £123,000 to the Grantham Company, these amounts representing the market values of the stocks of the canal companies. The Nottingham and Grantham Railway Company constructed the portion of their line between Nottingham and Grantham, and it was worked by the Great Northern Company at a percentage of the receipts up to the year 1861, when the whole undertaking, including the two canals, was leased to the Great Northern Company for 999 years at an annual rental equal to 4⅛ per cent upon the Nottingham and Grantham Railway Company's capital. The portion of the rent due to the Nottingham Canal is £4,641 per annum, and to the Grantham Canal £5,074, which amounts are equal to a dividend of 6½ per cent on the original capital of the canal companies, though the expenses on the canals at the present time are not covered by the receipts. The shareholders of the four canals were able to dispose of their property on the basis of their profits prior to the construction of the railway, when they enjoyed a monopoly and their tolls were high. The railway company, in addition to being placed under the burden of the guaranteed rents, were further required by the leasing or purchasing acts always to maintain the canals in an efficient condition.

### LOSS ON WORKING.

Traffic over the canals has steadily declined, until now the receipts are less than the cost of maintenance alone, and if the guaranteed rents be included there is an annual loss to the leasing company in respect of the four canals of £32,833. Mr. Bury has frequently had under consideration the question of how these canals could be worked more profitably, but he has not been able to devise a means by which the traffic might be developed or the cost reduced. The Great Northern Company do not themselves work traffic over the canals, their charges being simply for the use of the waterways, while the haulage and boats are provided by by-traders or canal carriers. The charges made by the railway company are the charges set out in the act of 1894, there being a minimum charge of 4s. per boat on the Witham and Nottingham and Grantham canals, 5s. per boat on boats passing between the Nottingham and Grantham canals, and 3s. per boat on the Fossdyke. A maximum toll of 8d. per ton is provided on the Fossdyke, irrespective of class or distance. Through tolls are charged between the Nottingham and Grantham canals, but there are no through tolls to or from other companies' canals. There is, however, so far as the Great Northern Company is concerned, nothing to prevent through rates being quoted by carriers or by-traders between other canals and Great Northern canals. It is not

practicable, even if desired, to arrange through rates from the railway to the canal and vice versa, as the services are not the same; on the railway the company provide the service of transport complete, whereas on the canals they are simply toll takers. On only one of the four canals, the Fossdyke, do the receipts from tolls cover the expenses, and this is due to a certain amount of through traffic being brought up to Lincoln from the Humber, via the Trent Navigation, thus passing from end to end of the Fossdyke. On the Nottingham and Grantham canals the traffic passes only for very short distances, the average toll paid per ton being 2d. and 3d., respectively.

It is evident from the small use made by the public of the Great Northern canals that they are no longer required. It has never been the policy of the owning company to discourage traffic on the canals so as to divert it to the railway, and no application has ever been made against the company under section 38 of the canal traffic act of 1888. The tolls charged at present are unremunerative, and Mr. Bury is confident that their reduction would not result in a compensating increase of traffic, but simply entail a further loss upon the company. The Great Northern canals fulfilled a useful purpose when constructed, as shown by the value of their shares and the dividends paid; but there is only a very small traffic for which they are adapted to-day, or could be adapted, and the senders of traffic followed a natural course in leaving the waterways and taking advantage of the superior facilities afforded by the railway. It has been stated frequently in the evidence that canals are of no advantage to agriculturists beyond the watering of cattle, and the experience of Great Northern canals proves this. The Witham is the only one on which practically any agricultural produce is carried, and here, although the navigation passes through a purely agricultural country, only the small total of 18,548 tons was carried in 1905. There is not the least doubt that had these canals not come under the control of the Great Northern Company they would long ago have been abandoned and left to their fate, as have been other privately owned canals when they ceased to be remunerative. As it is, the Great Northern Company, though there is no prospect of the traffic justifying the expenditure, are compelled to spend large sums of money in order to maintain the canals in a state of efficiency, though in the case of the Nottingham and Grantham canals the shortage of water is a difficulty that is not easy to overcome.

In the case of the Nottingham Canal, which was originally constructed to open communication between certain coal mines and the town of Nottingham, one of the principal sources of water supply has failed owing to the modern practice under which water is tubbed out of the coal shafts instead of being pumped into the canal, as provided by a clause in the construction act of 1792. As regards the suggested improvement of the Fossdyke and Witham Navigation, running from the Trent at Torksey to the port of Boston, Mr. Bury could not see the advantages that would result from such improvement, bearing in mind that this would not connect an inland center with the sea, but merely the ports on the Humber with a port on the Wash. The navigation, moreover, in its present state is capable of dealing satisfactorily with a far greater traffic than that now passing over it. With reference to the statement made by one witness that

a system of through canal and rail rates from places on the Witham, which had been in force for many years, was recently abolished, Mr. Bury pointed out that no through rates were in operation as stated, and all that has been done was to terminate an arrangement under which the railway companies bore the cost of barging traffic from farms and places on the Witham to Lincoln, where it was put on rail, and charged the farmer with the through rail rate from the station nearest to the point of origin of the traffic. The advantage to the latter was, of course, that he saved the cartage of his traffic to the station, and it has only recently been possible to stop a preferential arrangement under which the traders in one district obtained an advantage over adjoining districts, to which they had never been entitled—the rates charged being station-to-station rates. The effect of the change had been to put an end to a preferential arrangement.

Mr. Saner, in comparing the time of delivery by rail and water, stated that from London to Cheshire the time occupied in transit by parcels forwarded by railway is from four to five days, unless the consignment is large enough to fill a wagon, when probably only three days would be occupied; but Mr. Bury, by whose line parcels are carried to Cheshire, was quite unable to reconcile Mr. Saner's statement with the facts, and thinks he must have meant to refer not to parcels but to odd consignments of low-class goods or mineral traffic, as, on taking out particulars of the service given by the Great Northern route for parcels from London to various points in the provinces and in Scotland, it is shown that the time the parcels are generally in the company's hands is well under twelve hours.

### BRITISH CANALS UNPROFITABLE.

Mr. Bury believes that any large expenditure on canal revival at the present day could not be remunerative and would only result in a waste of public money, while proving of little benefit to the trade of the country. No doubt in certain districts, between particular points, there is traffic for which the existing canals will continue to provide a satisfactory means of transport, but considering the present trade requirements it is improbable that any effective competition for the great volume of traffic now handled by the railways could be maintained by an improved system of inland waterways, even supposing the necessary money were forthcoming and engineering difficulties overcome. Experience on a railway teaches that for all the general-goods traffic speed and punctual deliveries are indispensable. The traffic is forwarded in small lots, for which the ordinary railway truck is the most convenient size, and apart from traffic for shipment there is very little, even in the lower classes, such as bricks and coal, which is forwarded in large consignments. The railway system has been developed to enable all descriptions of traffic to be dealt with efficiently and economically, and neither in convenience, reliability, nor in cost would it be possible, Mr. Bury contends, for canals to offer any superior advantages. The physical and financial difficulties in the way of canals being laid out to afford equal facilities for the collection, carriage, and distribution of coal to those now given by the railways and colliery branches was supported by diagrams submitted by Mr. Bury, showing, first, the pits in a typical colliery district,

with the varying levels; and, secondly, great number of depots in all parts of the metropolis where accommodation has been provided by the railway companies to enable coal to be received and dealt with at the nearest convenient point to the area of distribution.

### A TRADER'S VIEWS.

Mr. GEORGE MACPHERSON, a member of the firm of Philip Williams & Sons, iron and coal masters, Wednesbury Oak, Tipton, a member of the committee of the Birmingham Canal Company; chairman of the South Staffordshire Ironmasters' Association (but not representing the latter at this inquiry); chairman of the South Staffordshire mines draining commissioners; and chairman of the Mond Gas Company, gave evidence. His works are situated on the banks of the canal in the center of the principal mining district, and he is a large trader thereon and has been so engaged for over thirty years. He has been a member of the committee of the Birmingham Canal Company for two years. Witness was able of his own knowledge to confirm the evidence of Mr. Jebb, the engineer of the Birmingham Canal Company, on many points. A great improvement has taken place in that canal since Mr. Jebb was appointed engineer in 1875, resulting in improved carrying capacity and a better supply of water. There is no other district in England where the effect of mining operations is so damaging to the surface as in the South Staffordshire Black Country, and the cost of maintaining the Birmingham Canal is therefore much greater than in the case of any other canal.

### ENLARGING OF CANALS IMPRACTICABLE.

The widening or deepening of the existing canals is, in the opinion of the witness, impracticable. Apart from the great cost, the stoppage of trade would be paralyzing. Most of the works are dependent on the canal for their trade and many would be positively ruined. The canal company would lose its traffic in the meantime and would probably find, when the improved canal was completed, that the traders who could would have made communications with the railways and would not return to the canal. The whole of the collieries between Wolverhampton and Birmingham, in the Tipton district, are entirely dependent on the canal, and in event of the canal being stopped for enlargement the collieries would be stopped and the pumping engines could not go on without the tonnage rates from the collieries, the mines would be flooded and ruined.

Eighty per cent of the trade on the canal is local. A widened canal would not induce a greater consumption of coal. The works on the canal side have had their basins constructed to take the present small boats and it would not be worth while to alter them to take larger boats. He would not do so as regards his own works. A portion of works in the district have railway sidings, but most of them obtain their coal and pig iron by canal. A widened and deepened canal would be of no advantage to them in getting their local supplies; only a small fraction of the works of the district would be on this through canal if made between Birmingham and Wolverhampton. All the works off the main canal would still have to use

their small boats, and these would be more economically worked on the present canal than on a wider one. The wide canals will not increase the value of the branch canals for local traffic, and the speed of the small boats when they come into this larger canal will be more retarded when they encounter the larger boats, going much slower.

ASSOCIATION WITH RAILWAY BENEFICIAL.

The association of the canal with the London and North-Western Railway has been of the greatest assistance to the canal company. The £700,000 contributed by the railway company has enabled improvements to be carried out, and if this money had not come from this source it would not have been obtainable. If the canal company had not received this assistance from the railway, and had pursued the lines in vogue up to 1875, most of the collieries in the district would long ago have been drowned out through the leakage of the canal and basins. The complaint that traffic is removed from the canal at an early stage in its journey by the railway companies is a matter not affected by the arrangement with the London and North-Western Railway. The Great Western and Midland railways compete with the London and North-Western in the district, and they are responsible for the construction of as many basins as the London and North-Western and have equal facilities for removing the traffic without any such responsibility as the London and North-Western has.

CHANGES IN TRADE CONDITIONS.

The course of trade has altered very much of recent years. Delivery is expected much quicker, and it is very doubtful whether traders would wait till a 60-ton boat was loaded if goods of less amount were ready to be forwarded. Witness is aware of the crowding and consequent block in the canal with the present traffic, especially in the neighborhood of the locks, which is evidence of the difficulty that would arise in case any larger quantity of traffic were put onto the canal.

Witness was not opposed to money being spent on improvements of canals, but it should not be done out of rates nor from taxation. In his opinion there would be no return on such an investment of capital.

RATES BY RAIL AND WATER.

Councillor G. H. Kenrick, of Birmingham, a hardware manufacturer, gave evidence on the question of rates for carriage of goods and the effect on them of competition by water carriage. He had circularized 34 manufacturers in his district likely to be affected, and the 32 replies indicated four conclusions: First, that finished goods were very little sent at present by canal; secondly, goods for export, especially if heavy or bulky, would very generally be sent by canal if the present cost of transit were reduced one-half; thirdly, such materials as iron and coal would be sent by canal more freely if better facilities and lower rates were offered; and, lastly, finished goods for home consumption might be sent in large quantities be-

tween such important centers as London, Birmingham, Liverpool, Manchester, Leeds, and Bradford.

Speaking of the Birmingham Canal Navigation, he said that all the old manufactories of the district, and many of the new, were situated on the system. If a national canal trust were formed, and main canals connecting the principal ports were made or improved, it would be necessary to include this system, as it would constitute a most important feeder. He did not think it would be practicable to widen the Birmingham Canal system, and transshipment could not be avoided, but he did not regard transshipment as a very serious difficulty. He would improve the barges to make them capable of going alongside ships, as that would avoid a second transshipment.

Mr. Joseph S. Taylor, chairman of the Birmingham Chamber of Commerce, said that the chamber comprised 850 business firms representing a wide range of trades. On account of the cost of carriage several firms had migrated from Birmingham. The cost of carrying raw materials and finished products were higher than on the Continent, and it affected both the foreign and home trade, with the general effect of impeding production. The chamber of commerce were of opinion that most of the present difficulties in the matter of transport were attributable to the inefficiency of the canals. In some cases the canal rate was no better than the railway rate. In others it was lower; but having regard to the defects of the system, the difference was not sufficient to induce traffic when the slowness of canal transport was considered. Thus the railways had a virtual monopoly, and, as with most monopolies which had to be worked solely for the benefit of the stockholders, the consumer or user was treated with scant consideration. Many articles manufactured in the Birmingham district were of considerable weight and bulk in proportion to their value, and their manufacture could only be developed under low transport rates.

### CANALS OF THE LONDON AND NORTH-WESTERN RAILWAY.

Sir Frederick Harrison, general manager of the London and North-Western Railway, said the canals belonging to his company have been well maintained, and whatever expenditure has been necessary to keep them in an efficient state has been met by the company. The Birmingham and Shropshire Union canals, as to which his company have certain statutory obligations, have likewise been efficiently maintained, and his company have paid a large sum annually for their upkeep. He considered that the traffic on the canals would not justify any outlay of capital beyond that spent by the London and North-Western, and witness did not consider that any increased facilities, improvements, or extensions can be given which would increase the user and warrant the cost. No benefit which the public would derive from improved waterways would be compatible with the cost. It is not expedient that public bodies or trusts should acquire the canals. If the waterways are taken over by the use of public money, there will not be anything like adequate return on the cost, and, consequently, it would be unfair to the general tax or rate payers, who would, under such system, be liable to increased taxation and especially unfair to the railway companies, who are such large tax and rate payers, and who would under such system be

liable to increased taxation with the avowed intention of endeavoring to set up competition with the railway out of public funds. If, however, as a matter of public policy, it was considered desirable that the State or some public authority or trust should take over the canals of the country, with the idea that such a course would cheapen and improve the means of transit, witness would not oppose such a scheme in principle, provided the transfer is effected on reasonable terms; or, in other words, that the London and North-Western Company receive reasonable compensation for the canals owned by them or under their control, including consideration for the money already expended upon them by the company, and that the railway company is relieved from any participation in any loss that may be sustained in the future by such transfer to State or other authority.

Following are the canals which the London and North-Western Company own, or in which they are directly interested: Birmingham, 159 miles; Shropshire Union, 201 miles; Lancaster (north end), 60 miles; Lancaster (south end), 14 miles; Huddersfield, narrow, 20 miles; Huddersfield, broad, 4 miles; St. Helens, 17 miles; Shropshire (coal port), 2 miles.

BIRMINGHAM AND SHROPSHIRE UNION CANALS.

Sir Frederick pointed out that when both these canals were free from railway control they and other canal companies foresaw that the public demand for the comparatively new and better means of transit by railway as compared with canals would seriously affect their prosperity, and in order to place themselves in as strong a position as they could for coming to terms with the railway companies they themselves promoted schemes for railways in opposition to schemes promoted by railway companies in order that they might be "bought off." They knew that the prosperous days of the canals were numbered and themselves promoted railways on or beside their waterways as the only means of preserving their territory from invasion. They sought, in fact, to make the good will of their business a valuable asset. Thus the Birmingham Canal Company, although they had their canal between Birmingham and Wolverhampton, promoted a railway alongside between the same points, knowing that the promotion of another line—the Stour Valley—would seriously affect their receipts, and the result was that the new railway company and the Birmingham Canal Company came to terms, the canal company finding one-fourth of the capital for the new railway. But for that witness thought the London and Birmingham Railway Company (now London and North-Western), who afterwards acquired the Birmingham and Wolverhampton and Stour Valley Railway Company, would not have sought any interest in the control of the Birmingham Canal.

In the case of the Shropshire Union Canal that company obtained three acts of Parliament in 1846 for the purpose of constructing three lines of railway and for the purpose of stopping up portions of its canals and converting same into railways: From Calveley to Wolverhampton; Shrewsbury to Stafford; and Crewe to Newton. The first and third of these were to be constructed for the most part on the actual site of the canals in opposition to the existing rail routes, while the remaining routes created an opposition line in competition with the Shropshire Union Company's own canals.

If the contests which took place in the early days of railways between the railways and canals had been fought under present conditions, especially with the act of 1873 prohibiting railway companies acquiring any interest in canals without the assent of the railway commissioners, Parliament would never have stood in the way of progress by railway construction, and the railways would not have had the canals forced on them. The Birmingham Canal and the Shropshire Union Canal companies' revenues would have decreased owing to the railway competition, and the canal companies not having a purse like that of the London and North-Western Company at their backs would not have had the money to spend on its upkeep and improvement, the cost having risen from £58,784 in 1865 to an average of £96,000 during the last ten years.

The case of the Shropshire Union Company is somewhat similar. Since 1885, to the end of December, 1905, the London and North-Western Company have had to contribute, in varying sums each year, the large amount of £1,022,949 to meet their liabilities under the Shropshire Union lease. Apart from this the cost of maintenance of the Shropshire Union Canals, in order to keep them in their high state of efficiency to which several witnesses have testified, has been considerable. Notwithstanding the evidence that has been given before the select committee of the House of Commons in 1883, and elsewhere, there is still an impression in the public minds that the railway companies acquired the canals in order to strangle them and draw the traffic to the railways. Speaking generally, everything goes to prove that in most cases the canals were forced upon the railways because of the public demand for railway transit as being the most expeditious method, and certainly as regards those canals in which the London and North-Western Company are concerned, they have been fully maintained and improved for the public benefit, which it would have been impossible for the canal companies to have done had they been left to their own resources. As regards rates, although many concessions have been asked for and granted on the grounds that they would mean increased traffic to the canal, the reverse has been the case, and the result has, of course, been a reduction of revenue. It is impossible to widen and deepen the Birmingham Canal, because to do so would mean the stoppage of nearly all the works on the banks of the canal.

The navigation could not become an important feeder to any one or more larger canals which it has been suggested could be made, for the traffic on the Birmingham Canal is practically all local traffic, and, as has already been shown by the evidence, at the present time the local traffic almost fully occupies the waterways and locks, and although it would not be impossible to pass a certain quantity of additional traffic over it, it must be borne in mind that such additional traffic would have to take its turn with the local traffic at the locks, and the delay would prevent any large amount of new or through business being done.

### RAILWAY CONTROL OF CANALS.

Mr. Frank Impey, of Birmingham, secretary of the South Staffordshire Freighters' Association, contended that the cost of transit had already led a number of firms to move out of the Midland dis-

trict, and other firms informed him that the cost of transit, unless reduced, must drive them to the coast. He considered that the chief cause preventing the full benefit and use of the canals for through traffic had been railway control, and this applied with the greatest force to the policy of the Birmingham Canal Company as dictated by the London and North-Western Company. It was impossible to pass traffic by canal from Birmingham to the ports and principal centers of industry without touching a railway-controlled canal, except in the case of traffic to the Bristol Channel, when loaded in Birmingham on the Worcester Canal and to London when loaded on the Warwick Canal. All South Staffordshire traffic and most Birmingham traffic must be loaded on the Birmingham Canal and start under railway control. The Stratford Canal, owned by the Great Western Railway, was much neglected, and in places very shallow.

The proper development of canal traffic could not take place under railway control, and the removal of this must be the first step toward improvement. There were, however, other causes which prevented traders from obtaining the full benefit of the waterways. These were the varieties of gauge, and the number of owners on any through route. No real benefit to the country could take place without an entire revolution; without the widening and deepening of the canals, so that they would become suitable for steam or mechanical haulage. As compared with railway transit, canals were at a disadvantage only in speed. What trade wanted was the freest competition. This could be obtained only by the canal owner being under the control of the various railway and canal traffic acts, in that the same tolls must be charged to and the same facilities afforded to all comers (including railway companies) under similar conditions, but leaving it to the independent carriers who would have no control of the waterway, and who would be open to competition to quote what rates they thought fit. Traders in Birmingham and the district were in favor of acquisition by the Government, so as to make the main trunk lines, at least, national highways under a national board of control. The South Staffordshire Freighters' Association hoped to submit evidence from an engineering point of view to show what alterations were possible, and how the system could best be linked up with the trunk lines. They hoped to show that what Mr. Jebb styled impossibilities were only difficulties. By some witnesses it had been urged that it would be unfair to increase the competition of canal-borne traffic with railway traffic by the application of national funds to the improvement of canals, but it was not suggested that the Government should do more than improve the waterways and act as toll makers. No suggestion had been made that they should act as carriers or provide the capital for the plant necessary for the conveyance of traffic. On through traffic, tolls were but a small percentage.

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# A TRAFFIC HISTORY

OF THE

# MISSISSIPPI RIVER SYSTEM

BY

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# SOURCES OF INFORMATION.

Traffic statistics of the waterways of the United States, particularly of the river systems, have been very unsatisfactory, and in spite of the care now taken to obtain information from the most reliable sources, they can be regarded even at present as only approximately correct. This is due to the fact that the United States Government has never assumed control of waterway traffic as it has of that of railways and hence has never requested from water carriers any statistical reports.

Such statistics as have been collected largely come from two sources: First, the organized commercial bodies of the larger cities, and, second, the reports of the Corps of United States Engineers, who, in their investigations and construction work upon the waterways, have collected under instructions such commercial statistics as were available and as were likely to assist the authorities in judging the probable commercial value of any engineering project. The United States engineers have in most cases collected their own information, but in some instances they have taken their facts second-hand from the commercial organizations, so that this voluntary machinery is frequently almost our only source of information. That the information secured in this way is far from satisfactory must be apparent at once. In the first place, many of the chambers of commerce have had no systematic plan for the preservation of records; some have lost their records by fire, others by the ravages of war. The annual reports of only one river city—Cincinnati—have been available previous to 1860 and these reports could be secured only as far back as 1848. Whatever of information, therefore, is desired from these sources must be obtained from such reprints as have been made by the commercial journals of the time or by the reports of the United States engineers. Moreover, such information as is available is almost useless because it lacks uniformity, is local in its outlook, and is presented in such haphazard fashion that no comprehensive picture of river commerce for any one year can be obtained by any combination of the local figures. Of more serious importance, however, is the fact that the statistics are probably in no case complete. If a boat captain, after securing a full load, chose to leave the dock without submitting a record of his cargo to the harbor master, there was no power that could prevent, and complaints of this character were frequent. Again there was no compulsory system of waybills or records of any sort, and products were frequently taken from port to port with no more formality than the transfer of the freight money to the purser's pocket. No reliance should be placed, therefore, upon the statistics of traffic presented in this discussion as a picture of the actual business of any particular year. However, it is fair to assume that they are of some value

when looked at comparatively. It is probable that the statistics of one year were taken in about the same manner as those of another. Hence, however inadequate the information may otherwise be, we may fairly draw conclusions as to the increase or decrease of traffic over a period of years.

Aside from occasional special studies which bear either directly or indirectly upon the subject under consideration, most of the information here given for the period previous to 1860 is derived from congressional documents, including special reports of government officials, or congressional committees, the annual reports of the Chief of Engineers, United States Army, and from current publications, such as Niles' Register and Hunt's Merchants' Magazine. Reference should also be made to the careful and detailed history of Mississippi River commerce in the Report on Internal Commerce of the United States for 1887.

For the period after 1860, the authorities already quoted have been drawn upon. In addition to these sources, annual reports of the chambers of commerce and similar commercial organizations of the principal river cities have been available, including the reports of commercial bodies in Cincinnati, Pittsburg, Louisville, Kansas City, New Orleans, St. Paul, and St. Louis. In addition there are the official publications of the United States Government, which have been very much more satisfactory in recent years, some of which have devoted considerable attention to water traffic.

The collection of statistics of traffic on internal waterways, so far as it was authorized by congressional statute, began with the river and harbor bills of 1866 and 1867, which required the Secretary of War to report on various works and to state the amount of commerce and navigation which would be benefited by the expenditures. This legalized a long-standing practice under which the Corps of Engineers reported the commercial statistics in the manner already described. On May 3, 1875, an act was passed which provided for an annual report by the Bureau of Statistics of "the actual cost of transporting freight and passengers on the railroads and on the canals, rivers, and other navigable waters of the United States, the charges imposed for such transportation of freight and passengers, and the tonnage transported." A Bureau of Internal Commerce was set up in the Treasury Department and the first report was issued in 1876 as Part II of the Annual Report on Commerce and Navigation.[1]

These reports continued to be issued with some irregularity until the inauguration of the Monthly Summary of Commerce and Finance, in 1901, which devotes a section to internal commerce. The statistics for the river systems as they appear in this summary are in most cases drawn from the monthly reports of the United States engineers, the latter being assisted in the collection of information by an act of Congress of February 21, 1891, which requires agents of all vessels navigating waterways under federal improvement to furnish statements of their vessel cargoes to the United States engineer officer in local charge of such improvements.

[1] The report entitled "Commerce and Navigation," devoted solely to foreign commerce, had been issued annually since 1822.

Other official publications of value which cover the period of the last twenty years include the volume on Transportation by Water, in the Census of 1890, and the Special Census Report on Transportation by Water in 1906, and the Preliminary Report of the Inland Waterways Commission, 1908, containing much information collected by the Bureau of Corporations. This material is now being published by the Bureau of Corporations in more extended form in a series of volumes. The first two parts have appeared, and discuss General Conditions of Transportation by Water (pt. 1) and Water-borne Traffic (pt. 2). All of these publications have been freely drawn upon in the preparation of this study.

# DEVELOPMENT OF TRANSPORTATION ON THE MISSISSIPPI RIVER SYSTEM PREVIOUS TO 1860.

## I.

### BEFORE THE TIME OF STEAM.

In tracing the traffic history of the waterway system of the Middle West it is unnecessary to give more than passing attention to the period preceding the nineteenth century. The development of our internal resources hardly took its beginning until the close of the French and Indian war, in 1763, when Kentucky and Tennessee received their first settlers. During the Revolution a considerable trade sprang up between the Ohio River settlements on the one hand and New Orleans and the eastern seaboard on the other, the shipments of the middle western producers being down the Ohio and the Mississippi, but this was suddenly cut off with the enforcement by Spain of her commercial restrictions on the lower Mississippi after 1785. Not until the purchase of Louisiana in 1803 or even until after the war of 1812, was the Mississippi sufficiently free from obstructions or the traders sufficiently protected from annoyance and risk to permit the development of a steady and reliable traffic. The eighteenth century was to a considerable degree a time of exploration and discovery, of pioneering and adventure, and not a period of settled commerce. To be sure, commerce of a primitive kind was continuously present upon these interior waters, but it was only such commerce as exists wherever human beings who have things to exchange come into contact with one another.

The dates of admission to the Union of the first river States indicate, in a general way, the rapidity of settlement and the growth of a basis for commercial activity. The dates are as follows:

| | |
|---|---|
| Kentucky | 1792 |
| Tennessee | 1796 |
| Ohio | 1802 |
| Louisiana | 1812 |
| Indiana | 1816 |
| Mississippi | 1817 |
| Illinois | 1818 |
| Missouri | 1821 |

In 1810 about one million people were living in the western States and Territories. This number had more than doubled by 1820. The period of economic depression after the Revolution, the Peace of Amiens, which gave a sudden pause to the prosperity of our foreign carrying trade, the embargo, and the War of 1812, all serve as spurs to drive the people westward into the new lands along the waterways.

As prosperity increased and the settlers began to have surplus products for sale, the need for efficient transportation facilities upon

the rivers became increasingly urgent. Devices of all sorts had been resorted to, many of them borrowed from the Indians and pioneers. The canoe, often large and capable of carrying much freight, was one of the earliest means of transportation. With this went the pirogue, a boat hollowed out of a log and propelled by oars or setting poles. The freight carriers were, at the beginning, either the batteau or the barge. The former was made of rough plank and was capable of carrying heavier loads than the pirogue. The latter was one of the great burden bearers on the Ohio and Mississippi in the early days. The barge, carrying 40 or 50 to 100 tons, descended with the current and was worked upstream by any one of a number of devices, which included sail, oars, poles, "cordelles" (ropes by which craft were towed from the shore), warping, animal towage, and "bushwhacking" (hauling upon the overhanging branches along the banks).

Audubon, who took a trip up the Mississippi and Ohio in these days,[1] states that a barge would leave New Orleans on March 1 and frequently would not reach the falls of the Ohio at Louisville until July, and then it brought only a few barrels of coffee or, at most, 100 hogsheads of sugar. The number of barges in 1808 did not amount to more than 25 or 30, and the largest did not exceed 100 tons burden. These barges made one round trip a year or sometimes two under unusually favorable circumstances. The trip downstream from Pittsburg to New Orleans took about a month. It was the wearisome trip back which consumed the time. In a favorable stage of water, goods could be sent without break of bulk from New Orleans to Cincinnati; but if the water was low, transshipment at the falls of the Ohio at Louisville was necessary.

The keel boat, a long, narrow craft averaging 12 to 15 feet by 50, with both ends pointed, ran with the current and was poled upstream. This craft carried 20 to 40 tons. There were probably not over 300 to 400 of these boats regularly plying the Ohio in 1810. It is estimated that 150 of them made three voyages per season between Pittsburg and Louisville. Their peculiar advantage was in their narrow build, which permitted them to ascend the tributaries of the main rivers for long distances and to provide the necessary means of communication for the settlers of the interior. They distributed necessaries, such as salt and flour, and did the carrying trade of the portages. As their operators acquired knowledge of the danger points in the streams, their prestige grew and their patronage developed.

This form of craft was adapted for passenger travel by providing it with a covered deck. A regular packet service ran between Pittsburg and Cincinnati even before the beginning of the nineteenth century. From an advertisement of the first packet line, established in 1794, the following is taken:[2]

> First boat will leave Cincinnati this morning at 8 o'clock and return to Cincinnati so as to be ready to sail again in four weeks from this date. No danger need be apprehended from the enemy as every person on board will be under cover made proof to rifle balls, and convenient portholes for firing out. Each of the boats is armed with six pieces, carrying a pound ball; also, a good number of muskets, and amply supplied with ammunition, strongly manned with choice men, and the master of approved knowledge.

[1] Hulbert, Historic Highways, vol. 9, pp. 113–118.
[2] Ringwalt, Transportation Systems in the United States, p. 14.

The craft most extensively employed in early transportation, both by pioneers and regular traders, was the flatboat. This was the boat which never came back. Constructed rudely and cheaply, costing only from $20 to $50, it was used for downstream traffic along the banks of the Ohio and Mississippi. It was about 40 feet long, built square, and managed by oars. At the end of the journey in New Orleans it was sold for lumber and its former owner made his dangerous way back to the upper Ohio as best he could. The risks of the trip doubtless led many to undertake it purely in the spirit of adventure, yet much regular trading was carried on by this means.

Similar in character to the flatboat was the ark, employed for passenger travel, and the principal reliance of the emigrant.

In any complete description of early river craft it is necessary to include sailing vessels, which were built in the Ohio Valley during the last decade of the eighteenth century, and grew in importance. They were exclusively downstream craft, and were the export carriers for these sections, being constructed with a view to through journeys to the Atlantic coast or the neighboring islands. These ships were sometimes built of a capacity as great as 400 tons. They could, however, never attain any permanent place in the commerce of this section, because they were one-way carriers only, because the narrowness of the river restricted their necessary freedom of movement, and because the irregularity of water supply and the dangers of navigation made boats of deep draft impracticable.

The difficulties of navigation at that time can hardly be overestimated. Aside from the risks of hostile attack and the difficulties of upstream propulsion, and aside also from the dangers of snags and bars which have attended the later history of river navigation also, there were the difficulties of guiding the rude and unwieldy craft around the many islands and the numerous sharp bends, particularly in the upper Ohio.

"From February to June and from October to December were the best seasons for the navigation of the Ohio, although in the former season the floating ice often made the trip dangerous. Head winds were another frequent source of trouble. The river was so crooked that a favorable wind might within an hour become an unfavorable one, and these contrary winds contending with a strong current were not unlikely to drive the boat ashore. Boats sometimes passed from Pittsburg to the mouth of the Ohio in fifteen days and usually ten of these days were used in reaching the falls at Louisville. However, it was not unusual for a boat to be two weeks in reaching even Limestone, Ky."[1]

After the falls of the Ohio were passed, and this could be successfully accomplished only in high water, navigation was good for keel boats and barges of 100 to 200 tons.

The commerce floated upon the lower Mississippi and the Ohio in these first decades of the nineteenth century was of various origins. Besides that which came from settlements along the river banks, much traffic came down the tributary streams to be collected and transported on the main river systems. Manufactured articles and luxuries from the Atlantic seaboard destined for New Orleans and up-river points came to Pittsburg across the mountains, or to New Orleans by coasting vessel and then upstream by barge. The prin-

[1] Gephart, Transportation and Industrial Development in the Middle West, pp. 62–63.

cipal upstream traffic of the barges consisted of sugar and molasses, although groceries and other articles needed in the Northwest Territory were transported by this means. Downstream trade was largely in flour and whisky, but a more miscellaneous traffic was also common. Niles's Register of March 29, 1817, announces the arrival in New Orleans within the year of 529 flat-bottomed boats and 300 barges from the Western States and Territories, bringing a large variety of food products and household necessaries. This traffic was independent of the boats from lower Louisiana bringing cattle, corn, indigo, molasses, sugar, timber, and the like, and was also exclusive of the peddling traffic of those flatboats which disposed of their cargoes at plantations along the river banks before arriving at New Orleans.

Very little information is available concerning the cost of transportation during these early years. Ringwalt states that the charge between New Orleans and Cincinnati was about $5 to $6 per 100 pounds, or at the rate of about 7 cents per ton per mile, which was much below the average charge for haulage across the mountains from the east.[1] This statement is in practical agreement with that of Robert Fulton, who, in an argument for the building of Erie Canal in 1814, stated that the freight on a barrel of flour from New Orleans to Louisville was $4.50 per 100 pounds, or $9 per barrel, equivalent to 6.7 cents per ton-mile. This he contrasted with the downstream rate of $1.50 per barrel, or a little over 1 cent per ton-mile, the lower downstream rate being due to the greater ease of navigation and the larger supply of craft.

## II.

### THE STEAMBOAT AND ITS COMPETITORS.

The application of steam to interior river navigation began with the descent of the Ohio and the Mississippi by the steamboat *Enterprise*, later called the *New Orleans*, which left Pittsburg in September, 1811, and reached New Orleans in January, 1812, stopping on the way to receive congratulations and once retracing its path upstream for the purpose of demonstrating to an incredulous public its power to accomplish the feat. But it was long before the steamboat was to drive the less efficient craft from the rivers. In the first place, much experimenting was required before a boat could be built that was adapted to cope with the dangers of this unique navigation. Boats were at first built on the ship model with deep holds, and with too great draft for the shoal sections of the rivers. Not until the peculiar river type had been evolved—broad and flat, capable of carrying 1,000 tons when drawing only 4 feet of water, and with draft of only 2½ feet when empty—could the speed and the power be secured to overcome the many obstacles which the rivers offered.

A second hindrance to rapid steamboat development was the falls of the Ohio which, except in times of high water, divided the stretch between Pittsburg and New Orleans into two sections. Inasmuch as boat building was largely confined at the beginning to the upper Ohio and its affluents, where wood was abundant and the fitting out of steamboats could be more readily accomplished, steamboat commerce was slow of growth, because of the lack of a basis for rapid traffic development in the sparse settlements along the upper Ohio.

[1] Development of Transportation Systems in the United States, p. 17.

A third hindrance was found in the monopoly granted to Fulton and Livingston for the exclusive operation of steamboats upon the Mississippi for fourteen years within the limits of the State of Louisiana. If steamboats could not reach with their product the goal of river traffic, New Orleans, without paying heavy royalty, there was little to be gained from the operation of the Mississippi or of the Ohio below the falls. This monopoly was weakened in 1818, virtually abandoned in 1820, and given its official death blow by the decision of the Supreme Court in 1824 in the case of Gibbons *v.* Ogden, which destroyed the monopoly in interstate commerce of the same individuals on the waters of the Hudson.

It is not surprising, therefore, that the number of flat and keel boats and barges steadily increased during this period of steamboat beginnings. The country was settling rapidly, traffic was growing, the flatboats could carry heavier loads than the first steamboats, their operators were experienced pilots, who had acquired custom and good will, and though slow moving, they ranged farther in these early days than their steam-propelled competitors.

Many steamboat trips both up and down stream were made during the years immediately succeeding 1811, but students of transportation are agreed in setting the year 1817 as the one in which steamboat navigation passed from the experimental stage into a regular service. In that year the steamboat *Washington* made a trip from Louisville to New Orleans and return in forty-one days, the voyage upstream consuming twenty-five days. This trip dispelled the last of the remaining doubts and people from this time on accepted the steamboat as a necessary and normal factor in their economic life.

Steam navigation, while bringing about its results only gradually, had the effect of developing trade and, with the disappearance of monopoly, of lowering rates. The rates and fares prescribed by the State of Louisiana with the grant of monopoly to Fulton and Livingston remained in force until about 1819, when competition drove them down. As typical of these rates the following are given: From New Orleans to Louisville, 4½ cents per pound for heavy goods, and 6 cents for light goods, an average of about 5 cents per pound, or $100 per ton, equal to 7.5 cents per ton-mile. The passenger fare from New Orleans to Louisville was $125, or 9.4 cents per mile. The rates were cut in two on downstream traffic. The high passenger fare is partly accounted for by the fact that it included board on the trip. If twenty-five days be allowed for the uptrip and board be charged at $2 per day, the fare per mile is reduced to 5.6 cents. But no such deduction can be made in the case of freight where the charges seem to have been during the monopolistic period up to 1820, practically the same as before the appearance of steamboats. But it should be remembered that steamboats carried almost no freight until 1819, and that for many years thereafter they met the competition of the more primitive craft.

The flatboats not only persisted but they increased in numbers and capacity. They finally reached a size of 150 feet by 24 feet, carrying 300 tons of produce. Their traffic grew and flourished until the civil war practically put an end to it. Levi Woodbury, who took a trip down the Ohio and Mississippi in 1833, thus describes this form of trading:

> At every village we find from 10 to 20 flat-bottomed boats which, besides corn in the ear, pork, bacon, flour, whisky, cattle, and fowls, have an assortment of

notions from Cincinnati and elsewhere. Among these are corn brooms, cabinet furniture, cider, apples, plows, cordage, etc. They remain in one place until all is sold out, if the demand be brisk; if not, they move to another town. After all is sold out, they dispose of their boat and return with their crews by the steamers to their homes.

During these years the flats bore their cargoes to southern ports or to be retailed along the plantations of the Mississippi. Any enterprising man who could build a "flat" bought up the crops of the neighborhood, put them aboard and was ready to start on the "fall rise." Apples and potatoes were the staple through freight. Goods for peddling included cider, cheese, pork, bacon, cabbages, and apple and peach brandy. The development of the hay traffic from Indiana to New Orleans in the twenties opened a new field of usefulness for them. They seemed peculiarly adapted to the collection of produce on streams hardly navigable, such as the Wabash. During all this period the downstream traffic was the heavier, the upstream traffic consisting principally of coffee and sugar among the tropical products, and of manufactured goods and luxuries from the Atlantic seaboard and foreign ports.

Because the traffic was predominantly downstream and because the light traffic upstream could be taken care of by the steamboats, the keel boat found its usefulness at an end and rapidly disappeared. The flatboats, on the other hand, admirably supplemented the steamboats by carrying downstream the produce which the steamboats were not able to handle, by navigating streams where the risks of snags and bars were too great for the more valuable vessel, and where the settlements were sparse and the business light, and by converting themselves into lumber at New Orleans and thus removing themselves from the field of competition for the meager upstream traffic. As late as 1840 nearly a fifth of the freight handled on the lower Mississippi went by flatboat, keel, or barge, principally by flatboat. Steam towing of flatboats was tried as early as 1829, but was not successful, owing apparently to the lack of proper organization and to the prejudices of the flatboat owners.

The published statistics of flatboat arrivals at New Orleans are very incomplete. The craft was so informal in its movements that its arrivals and departures could not readily be registered. It should be noted, however, that two-thirds of the annual arrivals took place in January and February. It is estimated that in the decade 1820–1830, 3,000 flatboats annually descended the Ohio.

The following table presents the most satisfactory statistics available of flatboat arrivals at New Orleans for a series of years:

*Arrivals of flatboats at New Orleans.*

| | |
|---|---|
| 1845–46 | 2,763 |
| 1846–47 | 2,792 |
| 1847–48 | 2,111 |
| 1848–49 | 1,196 |
| 1849–50 | 1,184 |
| 1850–51 | 1,145 |
| 1851–52 | 1,468 |
| 1852–53 | 1,047 |
| 1853–54 | 701 |
| 1854–55 | 614 |
| 1855–56 | 718 |
| 1856–57 | 541 |

These figures show a steady decline in flatboat business up to 1860. The decline in general traffic of this form of craft becomes clearer if it be noted that of the 541 arrivals in 1856–57 at New Orleans 119 were coal flats from Pennsylvania and 136 were hay flats from Indiana. There was not in this year a single flatboat from the upper Mississippi or the Missouri, and only 12 from the Illinois. Flatboat trading after the original manner was resumed on a small scale after the civil war, the boats starting from Pittsburgh and Wheeling, and was continued until the high price of lumber put an end to the peddling business.

Sailing vessels of various kinds also continued to play a part in lower Mississippi trade, especially below New Orleans, although they sometimes ascended as far as Natchez to bring down cotton and sugar. But the steamboat was gaining rapidly on all its competitors. In 1826, 57 per cent of the freight was carried to New Orleans by steamboat and only 43 per cent by other means.[1]

The growing importance of the steamboat can be shown by presenting statistically the arrivals at New Orleans for a series of years.

*Arrival of steamboats at New Orleans.*[1]

| Year ending September 30— | Number. | Year ending September 30— | Number. |
|---|---|---|---|
| 1814 | 21 | 1839 | 1,551 |
| 1815 | 40 | 1840 | 1,573 |
| 1819 | 191 | 1841 | 1,958 |
| 1820 | 198 | 1842 | 2,132 |
| 1821 | 202 | 1843 | 2,324 |
| 1822 | 287 | 1844 | 2,570 |
| 1823 | 392 | 1845 | 2,530 |
| 1824 | 436 | 1846 | 2,770 |
| 1825 | 502 | 1847 | [2] 4,024 |
| 1826 | 608 | 1848 | 2,917 |
| 1827 | 715 | 1849 | 2,873 |
| 1828 | 698 | 1850 | 2,784 |
| 1829 | 756 | 1851 | 2,918 |
| 1830 | 989 | 1852 | 2,778 |
| 1831 | 778 | 1853 | 3,252 |
| 1832 | 813 | 1854 | 3,076 |
| 1833 | 1,280 | 1855 | 2,763 |
| 1834 | 1,081 | 1856 | 2,956 |
| 1835 | 1,005 | 1857 | 2,745 |
| 1836 | 1,272 | 1858 | 3,264 |
| 1837 | 1,372 | 1859 | 3,259 |
| 1838 | 1,549 | 1860 | 3,566 |

[1] Report on the Internal Commerce of the United States, 1887. [2] This figure is probably incorrect.

It will be seen that the steamboat arrivals, with certain slight recessions, steadily increased from the beginning of steamboat navigation until the civil war put a stop to commercial activity.

New Orleans, at the terminus of river transportation, grew with great rapidity, and was rated in 1840 as the fourth port in point of commerce in the world, exceeded only by London, Liverpool, and New York. Its exports were out of all proportion to its imports. It shipped heavy articles up the river, but for the finer classes of manufactures it left the Central West almost entirely dependent upon the eastern seaboard. Later, when the West went into manufacturing and Pittsburg and Cincinnati sent their manufactured goods south by river, New Orleans received them and reshipped them to the

[1] Report on the Internal Commerce of the United States, 1887.

plantations, and these shipments constituted most of the upstream traffic from New Orleans. There seems to have been very little direct trade between the western cities and the southern plantations.

To present a detailed table of traffic receipts at New Orleans for a series of years is impracticable, because the units of measure in which the products are set down vary so frequently as to make comparison difficult, if not impossible. An incomplete presentation of receipts in tons is here reproduced from the Report on Internal Commerce for 1887, together with a statement of total value of receipts. The latter is partly estimated and is affected by currency and market conditions. Nevertheless, the general conclusion to be drawn from it is obvious. It should be noted that the statistics of traffic do not include rafted products or goods brought to market in small boats by planters, of which no record was kept, but do include products received by way of Lake Pontchartrain, principally cotton, which varied in amount from 1 per cent to 6 per cent of the total.

*Tonnage and value of receipts at New Orleans from the interior, 1801–1860.*

| Year ending Sept. 30— | Quantity. | Value. | Year ending Sept. 30— | Quantity. | Value. |
|---|---|---|---|---|---|
| | *Tons.* | | | *Tons.* | |
| 1801 | 38,325 | $3,649,322 | 1834 | 327,800 | $29,820,817 |
| 1802 | 45,906 | 4,475,364 | 1835 | 399,900 | 37,566,842 |
| 1803 | 49,960 | 4,720,015 | 1836 | 437,100 | 39,237,762 |
| 1804 | | 4,275,000 | 1837 | 401,500 | 43,515,402 |
| 1805 | | 4,371,545 | 1838 | 449,600 | 45,627,720 |
| 1806 | | 4,937,323 | 1839 | 399,500 | 42,263,880 |
| 1807 | | 5,370,555 | 1840 | 537,400 | 49,763,825 |
| 1814 | 67,560 | | 1841 | 542,500 | 49,822,115 |
| 1815 | 77,220 | | 1842 | | 45,716,045 |
| 1816 | 94,560 | 9,749,253 | 1843 | | 53,728,054 |
| 1817 | 80,820 | 8,773,379 | 1844 | | 60,094,716 |
| 1818 | 100,880 | 13,501,036 | 1845 | | 67,199,122 |
| 1819 | 136,300 | 16,771,711 | 1846 | | 77,193,464 |
| 1820 | 106,706 | 12,637,079 | 1847 | | 90,033,256 |
| 1821 | 99,320 | 11,967,067 | 1848 | | 79,779,151 |
| 1822 | 136,400 | 15,126,420 | 1849 | | 81,989,692 |
| 1823 | 129,500 | 14,473,725 | 1850 | | 96,897,873 |
| 1824 | 136,240 | 15,063,820 | 1851 | | 106,924,083 |
| 1825 | 176,420 | 19,044,640 | 1852 | | 108,051,708 |
| 1826 | 193,300 | 20,446,320 | 1853 | | 134,233,735 |
| 1827 | 235,200 | 21,730,887 | 1854 | | 115,336,798 |
| 1828 | 257,300 | 22,886,420 | 1855 | | 117,106,823 |
| 1829 | 245,700 | 20,757,265 | 1856 | | 144,256,081 |
| 1830 | 260,900 | 22,065,518 | 1857 | | 158,061,369 |
| 1831 | 307,300 | 26,044,820 | 1858 | | 167,155,546 |
| 1832 | 244,600 | 21,806,763 | 1859 | | 172,952,669 |
| 1833 | 291,700 | 28,238,432 | 1860 | | 185,211,254 |

At the beginning the products were miscellaneous in character, but they gradually became specialized, southern products such as cotton, sugar, and molasses predominating. Cotton, which in 1816 represented only 12 per cent in value of total receipts, came to comprise in the later part of the period from 60 to 75 per cent of the whole. "Western produce," which was 35 per cent in value of the total receipts in 1850, amounted to only about 23 per cent in 1860.

## III.

### OHIO RIVER COMMERCE.

Up to 1820 and for some little time thereafter the trade of the lower Mississippi took its origin largely in the Ohio basin, where settlement was most advanced. In 1820 the State of Ohio alone shipped 200,000 barrels of flour by river; in 1824 the total exceeded 300,000 barrels, which was one-quarter in value of all the products which descended the Mississippi.

During this period much engineering work of varying utility was executed on the Ohio and its tributaries, which contributed to a greater or less extent to the efficiency of the river system. So far as the open channel of the Ohio was concerned, improvement work was begun as early as 1827, although little of value was accomplished before 1860.[1] Of the two tributaries at the head of navigation, the Allegheny was given up entirely to flats and rafts and was not navigable for even the lightest draft steamboats except during high water. So long as the supply of lumber upon its banks endured it furnished traffic for the river. Some of the lumber in the form of rafts of logs was floated to Cincinnati and below; much of it was converted at river ports into flats for downstream trading. To some extent it was converted into boards and shingles on the Allegheny and brought down in arks to Pittsburg, where the arks, relieved of their burden, were loaded with coal for Cincinnati, Louisville, and Natchez. It was estimated in 1848 that one-quarter of the lumber was sold at Pittsburg and the rest was carried farther down the Ohio. So late as 1859 it was stated that the lumber annually run down the Allegheny amounted to over 150,000,000 feet.[2]

The Monongahela River, which in its original condition could float light-draft flats and rafts in high and medium stages of water and steamboats at high water, was improved by private corporation—the Monongahela Navigation Company—which completed six locks before 1860, two of them near Pittsburg being in operation in 1841. Upon this river the coal trade of the Ohio originated—the one form of river traffic which has persisted with any vigor to the persent time. This trade began about 1840. In 1844 the total shipments amounted to 2,500,000 bushels. By 1847 the coal handled was about 12,000,000 bushels.

Until 1850 the method of handling was by means of large flat-bottomed boats or barges about 125 feet long and 8 feet deep. Each boat carried from 12,000 to 15,000 bushels of coal. They were ordinarily lashed together in pairs and floated down the river to destination, there to be sold for lumber. Each pair required the services of about twelve men. Inasmuch as the barges drew from 5½ to 7½ feet when loaded, they could only be floated safely during seasons of high water. There were generally two such stages a year, and during these relatively favorable seasons fleets of 250 to 300 barges set out upon their journey. Because their lading brought them so near the bed of the river and because they protruded so little above the water's surface, they were continuously subject to

[1] For more detailed discussion see Report of Commissioner of Corporations on Transportation by Water in the United States, Part I, 1909.
[2] Hunt's Merchants' Magazine, vol. 40, p. 604.

wreck from snags and rocks. Soon after 1850 the method of towing coal flats by steam towboats began.

Other tributaries of less importance which were improved to create more efficient connections with the main river, were the Muskingum, upon which the State of Ohio constructed eleven locks and dams, completed in 1840; the Kentucky, Green, and Barren rivers, improved by the State of Kentucky between 1835 and 1845 by the construction of locks and dams; and the Wabash River, upon which a lock and dam was built by the Wabash Navigation Company, chartered by the States of Illinois and Indiana, in 1846 and 1847.

Of more importance to the commerce of this section than any of the Ohio River tributaries just mentioned were the Cumberland and Tennessee rivers, both navigable for several hundred miles by steamboat. Indeed, the Tennessee River with its tributaries is navigable for steamboats a distance of 1,300 miles, and for rafts and flats an additional distance of more than 1,000 miles. Congress and the State of Kentucky made several appropriations for the improvement of the Cumberland between 1830 and 1840, and in 1846 the Cumberland Navigation Company was incorporated to improve navigation below Nashville, but little was accomplished during this period. From inland points in Alabama, Tennessee, and Kentucky by way of these two rivers came a large quantity of cotton, and most of the tobacco for southern markets and for export. During the few months of the year when the stage of water permitted, flatboats were extensively employed in this trade.

Probably the most important piece of river engineering from the standpoint of navigation, was the building of the Louisville and Portland Canal around the falls of the Ohio between Louisville and Shippingport, Ky. This was constructed by a private corporation chartered in 1825, the United States Government buying a majority of the stock. It was completed at the close of the year 1830, and in spite of the imposition of what seemed to be exorbitant tolls it had a most stimulating influence upon river commerce. Previously the flats and steamboats had been obliged to transfer their freight at Louisville to other craft sailing from Shippingport, below the falls, necessitating a laborious portage of 2½ miles, or else, if they desired to make the through trip, the running of the rapids. Either expedient involved heavy expense and loss of time. Running the rapids meant waiting for a favorable stage of water, with loss of interest on capital, additional wages, and loss by depreciation in the value of products, and also the direct expense of pilotage. Transfer at Louisville meant damage to goods and drayage cost. The opening of the canal united the two river lines between Pittsburg and New Orleans and uninterrupted through traffic was possible. Boats which had been limited to a maximum load of 900 tons could now carry 1,700 tons. During the year 1831, 406 steamboats, 46 keel boats, and 357 flats, a total of 76,323 tons, passed through the locks.

The growth in steamboat tonnage on the Ohio may be observed from the statistics of the Louisville and Portland Canal. The variation in different years is due to the stage of water, which, when sufficiently good, diverted the boats from the canal to the direct route over the falls. Yet the figures show a fairly steady increase in number of boats.

*Number of steamboats passing through the Louisville and Portland Canal, 1831–1849.*

| | |
|---|---|
| 1831 | 406 |
| 1832 | 453 |
| 1833 | 875 |
| 1834 | 938 |
| 1835 | 1,256 |
| 1836 | 1,182 |
| 1837 | 1,501 |
| 1838 | 1,058 |
| 1839 | 1,666 |
| 1840 | 1,231 |
| 1841 | 1,031 |
| 1842 | 983 |
| 1843 | 1,206 |
| 1844 | 1,476 |
| 1845 | 1,585 |
| 1846 | 1,626 |
| 1847 | 1,432 |
| 1848 | 1,523 |
| 1849 | 1,272 |

Among the cities along this commercial route, Pittsburgh, as a result of its strategic location, early assumed a position of importance. It had been the outfitting port for emigrants in the pioneer days, and was now, because of its situation at the junction of the Allegheny and Monongahela, in a position to profit by the extensive traffic in lumber and coal. It had developed into an important shipbuilding center, and but for the difficulties of upper Ohio navigation and the extraordinary enterprise of the Ohio commercial interests, might have overpowered the city of Cincinnati to such an extent as to make of it merely a port of call.

However, Cincinnati during these decades, because of its situation at the head of good navigation, became one of the leading commercial cities of the West. During the entire period to 1860 it was surpassed in population by only one western city, New Orleans, and in the census statistics of 1850 and 1860 its total population very nearly equaled that of the seaport city. It began building steamboats in 1819, and from that time on was the center of this industry. Wheeling, a little below Pittsburgh, became early an important outfitting point for flatboat traffic.

Louisville, at the head of the falls of the Ohio, early acquired an importance, because it was the transshipping point between the upper and lower river. The construction of the Louisville and Portland Canal did not do away altogether with this geographical division of steamboat lines, and Louisville retained its place of importance as a river port throughout this period.

Evansville, situated equidistant from the mouth of the Ohio and the falls, was an important distributing point for a well-settled territory; its largest export by water was tobacco, brought in from the Kentucky fields across the river.

On the lower river, the more important ports, aside from New Orleans, were Memphis, Vicksburg, and Natchez. Each of these, in 1843, shipped more cotton by river to New Orleans than it did in 1887. The average annual shipments of Memphis steamers down river were 100,000 bales, of Vicksburg, 75,000 bales, and of Natchez, 50,000. Natchez was, however, a more important river point than Vicksburg, because it was the center of a more populous district. Nashville, on

the Cumberland, was the center of a rich tobacco country, and sent large numbers of steamboats to New Orleans.

## IV.

### UPPER MISSISSIPPI COMMERCE.

The section watered by the sources of the Mississippi was occupied in the early part of this period by military garrisons and Indian traders. But it became before the war a region of active settlement, and furnished to the river a large amount of both freight and passenger traffic. The first steamboat that ascended the upper Mississippi is reported to have reached Fort Snelling, near St. Paul, in 1813. But the arrivals from that date until 1840 were few and far between, as the boats could be used only to transport supplies for traders and troops.

The total number of steamboat arrivals at St. Paul for the years 1844–1857 are here given, together with the length in days of the navigation season.

*Number of steamboat arrivals at St. Paul and length of navigation season, 1844–1857.*

| Year. | Steamboat arrivals. | Length of navigation season. | Year. | Steamboat arrivals. | Length of navigation season. |
|---|---|---|---|---|---|
| | | *Days.* | | | *Days.* |
| 1844 | 41 | 231 | 1851 | 119 | 238 |
| 1845 | 48 | 234 | 1852 | 171 | 216 |
| 1846 | 24 | 245 | 1853 | 200 | 233 |
| 1847 | 47 | 236 | 1854 | 256 | 223 |
| 1848 | 63 | 241 | 1855 | 560 | 217 |
| 1849 | 95 | 242 | 1856 | 837 | 212 |
| 1850 | 104 | 239 | 1857 | 1,026 | 198 |

The sources of the traffic may be shown in a general way by a statement of the ports of departure of steamboats for St. Paul during the year 1857.

*Arrivals of steamboats at St. Paul, 1857.*[1]

| From— | |
|---|---|
| Dubuque | 123 |
| Prairie du Chien | 138 |
| Galena | 213 |
| Fulton | 65 |
| St. Louis | 156 |
| Cincinnati | 12 |
| Pittsburgh | 27 |
| On the way to the Minnesota River | 292 |
| Total | 1,026 |

The years 1845 to 1860 covered a period of active settlement in the Northwest, and the Mississippi was the most available means for reaching the new territory. Most of the boats were built in the shipyards along the Ohio. They were operated largely by their individual owners. During the fifties, when Minnesota was rapidly preparing for statehood, and when Wisconsin and Iowa had just been received into the Union, the demand for transportation up the river far exceeded the supply, and almost any price was paid for the privilege. The result was that boats often paid for themselves in two years out of their earnings. But the risks of snagging and burning

[1] Hunt's Merchants' Magazine, vol. 38, p. 117.

were very great, and the depreciation on these boats was consequently heavy. The best boats for the upriver trade were the stern-wheelers of 200 to 300 tons, which were not liable to be hindered by the midsummer droughts. The boats that made the largest profits were those which in the later days of this period controlled the jobbing business and the railway connections at certain ports. This control was effected through the creation of pools between steamboat operators, which later developed in many instances into stock companies.[1]

The three principal points on the river above St. Louis were Rock Island, Galena or Dunleith, and Prairie du Chien. The immigrants who settled Minnesota and Wisconsin reached the river at these points, being transported that far by rail after 1854. But these towns were not only transfer points for passengers. Galena was at this time second only to St. Louis as a wholesale center. Other important upriver ports were Burlington, Dubuque, and Davenport, Iowa, and Quincy, Ill. These places had their beginnings as river junctions, increased in importance as connections with the interior became closer, and continued even after the advent of railways to confine their interest to the river so long as the lumber supply endured. They were all important lumber-manufacturing towns.

The freight traffic by steamer seems to have been of the miscellaneous character natural in an exchange between primitive communities lacking railway facilities. Potatoes, barley, and furs are found in the list. Wooden ware was shipped from St. Paul as far south as St. Louis. One of the principal products from the upper river was wheat, which was shipped in 2-bushel sacks. A 200-ton boat would carry 300 tons of grain. There were also shipments of flour, which grew in importance as capital was invested in milling in the Northwest. Flour shipments on the Mississippi for the years 1841–42 to 1844–45 were as follows:

*Shipments of flour on the upper Mississippi River.*

| | Barrels. |
|---|---|
| 1841–42 | 439,688 |
| 1842–43 | 521,175 |
| 1843–44 | 502,507 |
| 1844–45 | 533,312 |

But by far the most important product of upper Mississippi transportation, from the beginning until its decline at the close of the century, was lumber. This was handled almost entirely in rafts or barges propelled by steamboats.

In the lower section of the upper Mississippi a large traffic was for many years carried on in lead, principally from the Galena mines, and a smaller trade in Wisconsin copper. Large quantities of lead were annually transshipped at St. Louis for New Orleans, amounting in value in 1843 to more than $1,000,000, and estimated to be worth 3½ cents per pound. A small part of this total came from points in Missouri by way of the Missouri River.

[1] Merrick, Old Times on the Upper Mississippi, 1909.

The following table gives the shipments of lead from Galena, Dubuque, and all other up-river ports for a series of years:

*Total shipments of lead, in pigs, from Galena, Dubuque, and all other ports of upper Mississippi, 1841–1854.*[1]

| | Pigs.[2] |
|---|---|
| 1841 | 452,814 |
| 1842 | 447,859 |
| 1843 | 561,321 |
| 1844 | 624,601 |
| 1845 | 778,460 |
| 1846 | 732,403 |
| 1847 | 772,656 |
| 1849 | 590,293 |
| 1850 | 573,502 |
| 1851 | 503,571 |
| 1854 | 402,343 |

After 1854, when the railway reached the Mississippi, the lead traffic on the upper river rapidly disappeared.

The steady growth in the business of this portion of the river may be observed from the statistics of steamboat arrivals at St. Louis from the upper Mississippi for a series of years. These include all arrivals from Mississippi River ports north of the mouth of the Ohio.

*Arrivals of steamboats at St. Louis from upper Mississippi ports, 1841–1852.*

| | |
|---|---|
| 1841 | 143 |
| 1842 | 195 |
| 1843 | 244 |
| 1845 | 647 |
| 1846 | 663 |
| 1847 | 717 |
| 1848 | 697 |
| 1849 | 806 |
| 1850 | 635 |
| 1851 | 639 |
| 1852 | 705 |

The upper Mississippi business was considerably augmented before it reached St. Louis by that of the Illinois River and the Illinois and Michigan Canal. The latter was opened in 1848, and while inadequate for extensive traffic, it furnished, nevertheless, some freight to the Illinois River steamers, which transported goods back and forth between Peoria and other interior Illinois points on the one hand, and St. Louis and points on the Ohio and lower Mississippi on the other.

## V.

### MISSOURI RIVER COMMERCE.

The traffic of the Missouri River has never reached a position of great importance, and statistical material bearing upon it is very meager. Such commercial value as the river possessed was confined largely to the period preceding 1860, and even then its service consisted principally in facilitating the fur trade and carrying products to the military garrisons on its upper reaches. The American Fur

[1] From Hunt's Merchant's Magazine.

[2] A pig weighed about 60 pounds.

Company and some independent traders employed a number of steamboats and other craft, and at least once a year ascended the river to the mouth of the Yellowstone with supplies for fur trading, and the United States Army carried its supplies by boat up as far as Fort Benton. So late as 1860 the total value of the fur trade of St. Louis was $529,000, of which nearly all came down the Missouri River by boat. The river was also used to a considerable extent as a means of approach to the Santa Fe trail, which made junction with the river at Independence. The river trade between St. Louis and Santa Fe was valued in 1848 at $500,000 per year.

The first steamboat ascended in 1819, and from then on steamboating slowly developed. River navigation for the years 1838–1843 was as follows:

*Steamboat navigation of the Missouri River, 1838–1843.*[1]

| Year. | Boats. | Trips. |
|---|---|---|
| 1838 | 17 | 96 |
| 1839 | 35 | 141 |
| 1840 | 28 | 147 |
| 1841 | 32 | 162 |
| 1842 | 29 | 88 |
| 1843 | 26 | 205 |

[1] Hunt's Merchants' Magazine, vol. 18, p. 103.

The arrivals at St. Louis of boats from the Missouri River for the years 1845–1852 are presented in tabular form.

*Arrivals of steamboats at St. Louis from the Missouri River, 1845–1852.*

| | |
|---|---|
| 1845 | 249 |
| 1846 | 256 |
| 1847 | 314 |
| 1848 | 327 |
| 1849 | 355 |
| 1850 | 390 |
| 1851 | 301 |
| 1852 | 317 |

This table shows that commerce did not develop rapidly in this section. The figures are more significant if compared with the arrivals from the upper Mississippi, the Illinois, and the Ohio, which were much in excess of those from the Missouri, and were increasing rapidly. Aside from the difficulties of navigation due to the turbid and uncertain channel, the snags, the floods, and the droughts, there was the fundamental condition present that there existed on the upper Missouri previous to 1860 little industrial basis for an extensive river commerce. After 1860 the railways were the active agency in the settlement of this section, and the country once settled, this more efficient means of transportation was almost exclusively resorted to. The Missouri River has played practically no part in the industrial development of the west.

## VI.

### ST. LOUIS.

St. Louis was one of the important river cities of this period. It enjoyed the advantage of being a port of transshipment for a very large proportion of the river traffic, and was the great wholesale center of the Middle West. Most lines of steamboats engaged in through traffic on the Missouri, the upper and lower Mississippi, and the Ohio had St. Louis as one of their termini. The only important exceptions were the steamboat lines between Ohio River points and New Orleans, most of which did not touch St. Louis at all.

Hence, by reason of its location, there are found among the receipts of this city by river all the products which the rivers handled, including the grains and flour, lumber, lead, pork, lard, and bacon, the southern products, sugar, coffee, and molasses, and the miscellaneous food products. In and out of this metropolis the steamboats also carried what was for the time an enormous passenger business. Gold seekers, fur and Indian traders, immigrants, pioneers, and home seekers poured into St. Louis in the fifties, and found their way in and out by the river gate. The number of passengers carried on steamboats to and from St. Louis for the year ending September 30, 1855, is reported as 1,045,269.[1] The central location of this city and its growing commercial importance is seen from a statement of the steamboat arrivals.

*Arrivals of steamboats at St. Louis, 1839–1859.*

| | |
|---|---|
| 1839 | 1,476 |
| 1840 | 1,721 |
| 1841 | 1,928 |
| 1844 | 2,105 |
| 1845 | 2,050 |
| 1846 | 2,412 |
| 1847 | 3,069 |
| 1848 | 3,159 |
| 1849 | 2,905 |
| 1850 | 2,897 |
| 1851 | 2,628 |
| 1852 | 3,184 |
| 1853 | 3,307 |
| 1855 | 3,449 |
| 1856 | 3,065 |
| 1857 | 3,443 |
| 1858 | 3,160 |
| 1859 | 3,149 |

## VII.

### CANAL-LAKE COMPETITION.

The first danger that threatened the continued prosperity of river commerce came with the completion of the Erie Canal in 1825. The people of the Middle West and of the Ohio Valley were not slow to realize the advantage which a route including the Great Lakes and the Erie Canal would have in reaching seaboard markets, over the

[1] Hunt's Merchants' Magazine, vol. 33, p. 637.

2,000-mile river trip to New Orleans and the long coastwise journey. So early as 1832 the enterprising population of Ohio had completed canals from Portsmouth, on the Ohio, to Cleveland, and from Cincinnati to Toledo, and in 1835 there was shipped from this State to New York, by way of the Erie Canal, 86,000 barrels of flour, 98,000 bushels of wheat, 2,500,000 of staves, and much miscellaneous freight. The Ohio canals were built for local reasons and it was the local trade which sustained them during their years of prosperity. Yet they served as feeders for both the southern and eastern routes and helped to draw traffic away from its old course.[1]

Indiana likewise sought to reach eastern markets by the northern route, and constructed a canal from Evansville northeastward to connect with the Cincinnati-Toledo enterprise. Both in Indiana and Illinois the same competitive conditions existed as in Ohio, but with a stronger tendency in the former toward the river route. Not only did shipments, by way of the Erie Canal, particularly of wheat and flour, steadily increase, but the Pennsylvania Canal also transported a variety of products, including tobacco, which had formerly gone down the river, and took manufactures from about Pittsburg, and large quantities of lard, bacon, and other western produce. It imported various manufactured goods and household supplies for the people of the upper Ohio Valley. In 1846, Buffalo for the first time exceeded New Orleans in its receipts of flour and wheat.

The Cincinnati Price Current in 1852 contained a letter from Cincinnati merchants urging the greater cheapness of the northern route, and making the following comparative estimate of the cost of shipping a single hogshead of tobacco from Louisville:

BY NORTHERN ROUTE.

| | |
|---|---|
| Dray, Louisville | $0.25 |
| Freight to Cincinnati | 1.05 |
| Charges in Cincinnati | .50 |
| Freight by canal and lake | 7.75 |
| Insurance | 1.12 |
| | 10.67 |

BY SOUTHERN ROUTE.

| | |
|---|---|
| Dray, Louisville | $0.50 |
| Freight to New Orleans | 2.50 |
| Insurance to New Orleans | .62 |
| Charges in New Orleans | 1.75 |
| Freight by ship | 7.00 |
| Insurance | 2.00 |
| | 14.37 |

The point of highest traffic on the Ohio canals was reached in 1857, when the total amount carried was 1,635,744 tons. By 1850 the line of division between products moving south to the river and north to the Lakes had become rather clearly defined, and was somewhere near the center of the State. The tendency of breadstuffs was toward the Lakes, as already indicated, but beef, lard, pork, bacon, and corn still went mostly by river. This was in part due to the natural distribution of the supply of products in the State, and in part to the

[1] Gephart, Transportation and Industrial Development in the Middle West, pp. 118–119.

location of the demand for the different kinds of produce. But it appears certain that the river trade did not suffer seriously from the competition of eastward water routes during the period 1825 to 1850. Rather was it changing its character and including a larger proportion of southern and a smaller proportion of western products.

The following tables give the value of products received at the seaboard and the movement toward the interior in 1851 by the various routes:

*Reported value of products received at seaboard, 1851.*[1]

| | |
|---|---|
| Via the Mississippi | $108,051,708 |
| Via canals and the Hudson | 53,027,508 |
| Via the St. Lawrence | 9,153,580 |
| Via the New York railroads | 11,405,350 |

*Movement toward the interior, 1851.*

| | |
|---|---|
| Via the Mississippi | $38,874,782 |
| Via the Hudson and canals | 80,739,899 |
| Via the St. Lawrence | 10,956,793 |
| Via the New York railroads | 44,556,000 |

These tables, besides showing the relative importance of Mississippi River traffic, bring out the preponderance of export over import traffic at New Orleans referred to elsewhere.

## VIII.

### RATES AND FARES.

No satisfactory material is available on the question of rates during the period preceding the introduction of railways into the West, and only general statements may here be ventured. In 1819, when steamboating on western rivers was first freed from the Fulton monopoly, through passenger rates upstream were about 10 cents per mile, varying somewhat for the longer distances, and 12½ cents per mile for way passengers. The downstream rate was about 6 cents per mile. It is probable, however, that these rates included board en route, and allowance should be made for this in comparing them with modern rates. A few typical fares may be quoted.

*Passenger fares by steamboat, 1819.*

| | Miles. | Fares. |
|---|---|---|
| New Orleans to Natchez | 263 | $30 |
| New Orleans to mouth of Ohio | 961 | 95 |
| New Orleans to falls of Ohio | 1,328 | 125 |
| Falls of Ohio to New Orleans | 1,328 | 75 |
| Falls of Ohio to mouth of Ohio | 367 | 20 |
| Falls of Ohio to Natchez | 1,065 | 60 |
| Cincinnati to Louisville | 129 | 12 |

On the upper Mississippi, the fares had fallen by 1840 to from 4 to 5 cents per mile for short distances and 3 cents per mile for long distances. Deducting the price of meals and stateroom, the charge was

[1] Ringwalt, Development of Transportation Systems in the United States, p. 121.

from 1½ cents to 3 cents per mile. Deck passengers, who were expected to provide their own food, traveled at fares which frequently did not exceed a half cent per mile, and this they could still further reduce by assisting the crews to gather fuel at the various stopping places.

There were no such things as typical freight rates during the era of steamboating. Rates varied widely with the supply and demand of boats, the stage of water, and the quantities of freight offered, and it is difficult to give any idea of them at all. For example, one writer quotes a rate in 1819 of 15 cents per 100 pounds from Cincinnati to Louisville, or 2.3 cents per ton-mile, and another rate in the same year from Cincinnati to St. Louis of 50 cents per 100 pounds, or $1.44 per ton-mile. Gephart states[1] that the freight rates from New Orleans to northern cities in 1822 were as follows: General merchandise, 3 to 4 cents per pound; cotton, 1 cent per pound; sugar, $7 per barrel. These rates were probably not more than half as high as the rates charged before the appearance of steamboats. So early as 1839 rates were quoted from New Orleans to St. Louis of 75 cents per 100 pounds or $0.013 per ton-mile, and from New Orleans to Louisville of 50 cents per 100 pounds, or $0.008 per ton-mile, the latter rate being lower because of the greater competition on this line. In seasons when a good stage of water prevailed, between 1850 and 1860, freight was carried from Pittsburgh to St. Louis and Nashville at 43 mills per ton-mile, and from Pittsburgh to New Orleans at 36 mills per ton-mile. Merrick[2] states that freight rates varied on the upper Mississippi in the fifties from 25 cents per 100 pounds for short distances, to $1.50 per 100 pounds from Galena to St. Paul, the latter being nearly 10 cents per ton-mile. No package was carried for less than 25 cents. To the rates themselves must be added the cost of marine insurance, which, because of the hazardous nature of the steamboat business, was a very heavy expense. In 1840 the insurance rate quoted was about 1¾ per cent of the value of the goods for a distance of about 200 miles above New Orleans; then it steadily increased to 4 per cent and above on the upper Mississippi. On the Ohio the rates varied from 2⅓ to 3⅜ per cent, on the Missouri from 3⅝ to 6½ per cent.[3]

Downstream rates for both passenger and freight traffic were usually lower than those levied on upstream business, because the time consumed being less, the cost of operation was less in fuel and power expended, and, in the case of the passenger business, the expense of boarding the passengers was reduced. But these factors might be entirely offset by the supply of and demand for space in the two directions at different seasons of the year. In fact too much reliance should not be placed upon any casual statement of rates or fares, because, being subject to no control whatever except such as the laws of trade enforced, steamboat captains charged in all cases what the traffic would bear. It was frequently much more advantageous to a prospective passenger to pay the exorbitant fare demanded than to stay in port and take his chances with the next boat, and a shipper had to get his products to market at any cost. The days of prosperous steamboating were the days of unregulated mo-

[1] Transportation and Industrial Development in the Middle West, p. 98, note.
[2] Old Times on the Upper Mississippi, 1909.
[3] Hunt's Merchants' Magazine, vol. 2, p. 80.

nopoly, and the variations in water depth and the uncertainties of travel often so crowded the limited traffic season that in the direction of traffic movement passengers and shippers were wholly at the mercy of the steamboat captains. Small wonder that boats were often paid for out of the earnings of a couple of years. Yet they were continuously liable to destruction from snags, bars, collisions, explosions, and burning. And even if they survived these terrors, so flimsy were they built and so recklessly were they run that most of them were unfit for service after five years.

The following table is made up from monthly quotations of rates on typical shipments on two steamboat lines which were operating where conditions were probably more stable at the time than on any other part of our inland waterway system:

*Summary of monthly quotations of river rates of freight, Cincinnati to New Orleans, 1849–1853.*[1]

| Product shipped. | 1848–49. | 1849–50. | 1850–51. | 1851–52. | 1852–53. |
|---|---|---|---|---|---|
| Flour, per barrel | $0.30–$0.75 | $0.25–$1.25 | $0.35–$1.00 | $0.30–$0.75 | $0.30–$1.00 |
| Pork, per barrel | .40– .75 | .25– .875 | .40– .90 | .35– 1.00 | .35– 1.00 |
| Whisky, per barrel | .45– 2.50 | .40– 1.00 | .50– 1.50 | .45– 2.50 | .50– 2.00 |

*Summary of monthly quotations of river rates of freight, Cincinnati to Pittsburgh, 1849–1853.*[1]

| Product shipped. | 1848–49. | 1849–50. | 1850–51. | 1851–52. | 1852–53. |
|---|---|---|---|---|---|
| Whisky, per barrel | $0.35–$1.50 | $0.35–$0.75 | $0.33–$0.75 | $0.30–$1.50 | $0.35 –$1.50 |
| Merchandise, per 100 pounds | .10– .50 | .10– .55 | .10– .25 | .10– .50 | .125– .75 |

[1] From Hunt's Merchants' Magazine.

## IX.

### SPEED AND ACCIDENTS.

Steamboat disasters on the Mississippi during the forty years from 1810 to 1850 have been thus summarized:[1]

| | |
|---|---|
| Total number of steamboats lost | 1,070 |
| Tonnage | 85,256 |
| Cost | $7,113,940 |
| Persons killed and injured | 4,180 |

Many of the accidents were due to conditions of navigation over which the navigators had no control, but many more were due to reckless steamboating. So long as there was no rail competition, speed was an object. A speed record was a profitable means of advertising, and the desire to attain it led to racing and resulted frequently in collisions and explosions.

Steamboats were being steadily perfected, and the length of time consumed between river ports was constantly reduced. The average

[1] Report on Internal Commerce of the United States, 1887.

rate of speed on the Mississippi and Ohio in 1840 was about 6 miles per hour upstream and 10 to 12 miles downstream, but this rate was frequently exceeded.

The following tables show the increase in steamboat power during the period up to 1860.

*Average time of steamboats between points named.*[1]

| | Year. | Time. |
|---|---|---|
| New Orleans to St. Louis | 1815 | 25 days. |
| | 1823 | 12 days. |
| | 1826 | 9 days, 12 hours. |
| | 1828 | 9 days, 4 hours. |
| | 1860 | 3 days (running time). |
| New Orleans to Louisville | 1819 | 20 days. |
| | 1826 | 10 to 14 days. |
| | 1840 | 6 days. |
| Louisville to New Orleans | 1819 | 10 days. |
| | 1826 | 6 days. |
| | 1840 | 4 days. |
| Louisville to Cincinnati | 1819 | 40 hours. |
| | 1840 | 15 hours. |
| Cincinnati to Louisville | 1819 | 18 hours. |
| | 1840 | 11 hours. |

[1] Hunt's Merchants' Magazine, vol. 48.

The following are taken from a list of speed records of individual boats:[2]

| | Year. | Time. |
|---|---|---|
| New Orleans to Cairo (961 miles) | 1844 | 3 days, 6 hours, 44 minutes. |
| | 1854 | 3 days, 3 hours, 40 minutes. |
| | 1870 | 3 days, 1 hour, 1 minute. |
| New Orleans to Louisville (1,328 miles) | 1815 | 25 days, 2 hours, 4 minutes. |
| | 1819 | 20 days, 4 hours, 20 minutes. |
| | 1828 | 18 days, 10 hours. |
| | 1834 | 8 days, 4 hours. |
| | 1842 | 5 days, 14 hours. |
| | 1852 | 4 days, 20 hours. |
| | 1859 | 4 days, 9 hours, 19 minutes. |
| New Orleans to Cincinnati (1,457 miles) | 1843 | 5 days, 18 hours. |
| | 1881 | 5 days, 12 hours. |

[2] Report on Internal Commerce of the United States, 1887.

## X.

### THE BEGINNING OF RAILWAY COMPETITION.

With the appearance of railways in the West begins the downfall of river commerce. In order to make clear the manner in which railways invaded the territory previously served by the waterways, the following table is presented, showing the more important railway lines opened for business previous to 1860 which touched any one of the waterways under consideration, together with the date of opening, the water terminus of the line, and the present name of the corporation.

*Table of principal western railways, 1841–1860.*

| Name of railway. | Date of opening. | Water terminus. | Present name of owning or controlling corporation. |
|---|---|---|---|
| OHIO. | | | |
| Little Miami | 1846 | Cincinnati | Pittsburgh, Cincinnati, Chicago and St. Louis. |
| Cleveland, Columbus and Cincinnati. | 1851 | ....do | Cleveland, Cincinnati, Chicago and St. Louis. |
| Cleveland and Pittsburgh | 1852 | Cleveland, Pittsburgh. | Pennsylvania. |
| Marietta and Cincinnati | 1857 | Cincinnati | Baltimore and Ohio. |
| INDIANA. | | | |
| Madison and Indianapolis | 1847 | Madison | Pittsburgh, Cincinnati, Chicago and St. Louis. |
| Indiana Central | 1853 | Across the State | Do. |
| Indianapolis and Terre Haute | | | |
| New Albany and Salem | 1854 | New Albany | Chicago, Indianapolis and Louisville. |
| Evansville and Crawfordsville | 1858 | Evansville | Evansville and Terre Haute. |
| KENTUCKY. | | | |
| Louisville and Frankfort | 1851 | Louisville | Louisville and Nashville. |
| ILLINOIS. | | | |
| Chicago and Rock Island | 1854 | Rock Island | Chicago, Rock Island and Pacific. |
| Galena and Chicago (jointly with Illinois Central). | 1855 | Galena | Chicago and Northwestern. |
| Chicago and Alton | 1855 | Alton | Chicago and Alton. |
| Chicago, Burlington and Quincy | 1856 | Quincy | Chicago, Burlington and Quincy. |
| Illinois Central | 1856 | Cairo, Dunleith | Illinois Central. |
| Terre Haute and Alton | 1854 | Alton, Ill | Cleveland, Cincinnati, Chicago and St. Louis. |
| Ohio and Mississippi | 1857 | Cincinnati, Ohio; East St. Louis, Ill. | Baltimore and Ohio Southwestern. |
| WISCONSIN. | | | |
| Milwaukee and Prairie du Chien | 1857 | Prairie du Chien | Chicago, Milwaukee and St. Paul. |
| Milwaukee and La Crosse | 1858 | La Crosse | Do. |
| MISSOURI. | | | |
| Pacific of Missouri (40 miles) | 1853 | St. Louis | Missouri Pacific and St. Louis and San Francisco. |
| Hannibal and St. Joseph | 1859 | Hannibal, St. Joseph | Hannibal and St. Joseph. |
| TENNESSEE. | | | |
| Western and Atlantic of Georgia | 1850 | Chattanooga | Nashville, Chattanooga and St. Louis. |
| Nashville and Chattanooga | 1854 | Nashville, Chattanooga | Do. |
| Virginia and Tennessee | 1856 | Chattanooga | Norfolk and Western. |
| Memphis and Charleston | 1857 | Memphis, Chattanooga | Southern. |
| East Tennessee and Virginia | 1858 | Chattanooga | Do. |
| Mobile and Ohio | 1859 | Columbus, Ky.; Mobile, Ala. | Mobile and Ohio. |
| Louisville and Nashville | 1859 | Louisville, Ky.; Nashville, Tenn. | Louisville and Nashville. |
| MISSISSIPPI. | | | |
| Vicksburg and Jackson | 1841 | Vicksburg | Alabama and Vicksburg. |

It appears from this table that railway building in the West began in the decade 1840–1850, and that the practice of building comparatively short railway lines to connect with the waterways developed rapidly during the next decade. These water and rail junctions were established all the way down the Ohio and lower Mississippi and on the upper Mississippi as far north as La Crosse, Wis., as well as on the Cumberland, Tennessee, and Missouri. Among these junction points were Pittsburgh, Pa., Cincinnati, Ohio, Louisville, Ky., Madison, New Albany, and Evansville, Ind., on the Ohio River; Chattanooga, Tenn., on the Tennessee River; Nashville, Tenn., on the Cumberland River; Cairo, Ill., Columbus, Ky., Memphis, Tenn., and Vicksburg, Miss., on

the lower Mississippi; St. Louis and Hannibal, Mo., Alton, Quincy, Rock Island, Galena, and Dunleith, Ill., Prairie du Chien and La Crosse, Wis., on the upper Mississippi; and St. Joseph, Mo., on the Missouri River.

There is some basis in this situation for the statement so often made that railways at the beginning were merely short lines connecting interior communities with waterways and were intended to supplement and not compete with waterway facilities.

For example, the Vicksburg and Jackson acted merely as a tributary to the river and transported cotton from the interior for shipment. Its business in cotton grew from 34,901 bales in 1847 to 97,868 bales in 1853.[1] The Pennsylvania Railroad for a time after reaching Pittsburgh was dependent upon the Ohio for traffic connections with the West. The president of the Madison and Indianapolis, in his annual report for 1850, made the following statement:

> The wharfage in front of the freight depot at Madison has been completed. The Cincinnati and Louisville packets now receive and discharge their freight and passengers at this point.

One reason why railways at the beginning did not at once supersede the waterways was that it was some time before they were properly organized and equipped to carry freight. The Baltimore and Ohio in 1831 had carried only 593 tons of freight, but had transported 81,905 passengers. The Cincinnati, Hamilton and Dayton was opened in 1852 for the operation of passenger trains only.[2] It required some effort on the part of railways to draw the bulky freight away from the waterways.

Yet, if the policy of cooperation prevailed at the beginning it had only a brief term of existence, for the economic conditions were such as to drive railways inevitably into the position of competitors. Referring again to the railways mentioned in the table, it may be noted that in Ohio the Little Miami, in connection with the Mad River Railroad, formed in 1848 the first through line between Lake Erie and the Ohio River, and that a second through line was created in 1851 by the Little Miami and the Cleveland, Columbus and Cincinnati. These highways across the State were inclined, like the canals, to divert traffic northward to the Lakes and thence to the eastern markets. But it was not long that the Lakes had to be relied upon for transportation eastward. The trunk lines of the Atlantic seaboard, spurred on by the rivalry of the seaboard cities, were pushing their way rapidly westward, and many of them took their course through the advantageous opening south of the Lakes and north of the mountains offered by the State of Ohio. The last link between Chicago and New York in what is known to-day as the "Vanderbilt system" was completed between Cleveland and Toledo in 1853. The Cleveland and Pittsburgh, which formed a part of the Pennsylvania, began operations in 1852, and the Pittsburgh, Fort Wayne and Chicago reached Chicago in 1858, forming the first continuous line through Ohio from the Ohio River to Chicago. The Baltimore and Ohio, as it passed through the State, extended its line to Cincinnati in 1857 by means of the Marietta and Cincinnati. The State of Ohio was therefore by 1860 opened up by rail lines in all directions. The same influences were at work elsewhere.

[1] Report on Internal Commerce of the United States, 1887.
[2] Gephart, op. cit., p. 172.

Across the State of Indiana ran several lines, including the Indiana Central and the Indianapolis and Terre Haute. The Terre Haute and Alton and the Ohio and Mississippi both paralleled the Ohio River and reached out to the Mississippi. The New Albany and Salem, opened in 1854, was the first line entirely within the State of Indiana connecting the Ohio River, at the foot of the falls, with the Lakes.

Farther south railroad building was less advanced, yet even in that territory roads from the East were seeking western waterway connections, with no other possible purpose than to turn traffic eastward which had earlier been moving west and south. For example, the Western and Atlantic of Georgia opened a route from Atlanta to Chattanooga on the Tennessee River in 1850, the Virginia system of railroads made connection with the same city through the opening of the Virginia and Tennessee in 1856 and the East Tennessee and Virginia in 1858. At the same time Chattanooga was pushing its influence westward, and had secured a connection with Nashville on the Cumberland in 1854 and with Memphis on the Mississippi in 1857. Two years later there was direct connection by rail between Louisville on the Ohio and Nashville, and between Mobile, Ala., and Columbus, Ky., on the Mississippi, a short distance below Cairo. In 1860 the Vicksburg and Jackson was extended to Meridian, where it met the Mobile and Ohio, and thus made possible the diversion of traffic from the Mississippi eastward.

On the upper Mississippi the first railroad connection with Chicago was made at Rock Island in 1854. Previous to this time only a small proportion of the exports of Illinois had been sent to market by the Lakes and the Erie Canal. The Illinois River, navigable to within 100 miles of Chicago, and the Mississippi along the western border of the State, had given a southerly direction to a good share of its products. All the products of the west bank of the Mississippi and the greater part of those of the east bank had gone to New Orleans. But now all was to be changed. The Rock Island connection with the Mississippi was followed by junctions at Galena and Alton in 1855, and the next year the Illinois Central had a line paralleling the river all the way from Dunleith, opposite Dubuque, to Cairo. Lines also connected Milwaukee, on Lake Michigan, with Prairie du Chien and La Crosse, on the Mississippi, in 1857 and 1858. West of the river there were no railways of importance previous to 1860, except the Hannibal and St. Joseph, opened in 1859, the Mississippi and Missouri from Davenport to Iowa City, Iowa, 55 miles, and the Pacific Railroad, constructed westward from St. Louis for a short distance.

That these various short roads to the Mississippi and the Ohio ceased construction for a time with the attainment of their river junctions was due in no sense to the fact that they regarded themselves as waterway feeders. The leading causes for the suspension of railroad building were found, first, in the financial situation which culminated in the panic of 1857; second, in the disturbance to business and credit which came with the civil war; and third, to the difficulties in the way of bridging the Ohio and Mississippi. The first two causes require no discussion. The bridge problem was an interesting one. A highway drawbridge had been erected over the Ohio at Wheeling in 1849, and between 1853 and 1856 the Chicago

and Rock Island had built a bridge across the Mississippi between Rock Island and Davenport to make connection with the Mississippi and Missouri Railroad in Iowa. Both bridges had been built by state authorization alone, and without the sanction of Congress. Both interfered seriously with navigation. For these reasons further bridging was bitterly fought. The opposition of steamboat interests, prompted in part, at least, by a desire to check railroad advance and compel alliance with the waterways, had a legitimate basis in the contention that unless bridges were provided with draws, reconstruction of the smokestacks and pilot houses of the steamboats would be necessary, and that unless the piers were placed wide apart, and spans of 500 feet were constructed, rafting and barging would be seriously hampered. Congressional investigation followed, resulting in general legislation under which bridges were built in the late sixties and in the seventies. Then the railways continued their course west and south, or made lines continuous which were already in existence on either bank of the river; but until congressional authorization had been secured, the railways rested in their westward and southward advance.

Even in the decade previous to the civil war the railways, with their through lines from Chicago to New York and their connections with the Mississippi and the Ohio, had already begun to draw traffic eastward, and to diminish the river commerce to New Orleans in northern products, or in what was known in New Orleans as "western produce." This may be shown in a general way by presenting a table which gives for the eleven years preceding the war the value of "southern produce," in detail, and the aggregate value of other products, mainly from the North and West.

*Value of receipts of produce at New Orleans, 1850–1860.*[1]

| Year ending September 30— | Cotton. | Sugar. | Molasses. | Tobacco. | Other products. | Total. |
|---|---|---|---|---|---|---|
| 1850 | $41,885,156 | $12,396,150 | $2,400,000 | $6,166,400 | $34,049,173 | $96,897,873 |
| 1851 | 48,756,764 | 12,678,180 | 2,625,000 | 7,736,600 | 35,127,539 | 106,924,083 |
| 1852 | 48,592,222 | 11,827,350 | 4,026,000 | 7,196,185 | 36,409,951 | 108,051,708 |
| 1853 | 68,759,424 | 15,452,688 | 5,140,000 | 7,938,650 | 37,442,973 | 134,233,735 |
| 1854 | 54,749,602 | 15,726,340 | 3,720,000 | 4,228,100 | 36,912,756 | 115,336,798 |
| 1855 | 51,390,720 | 18,025,020 | 1,255,000 | 7,111,370 | 36,424,713 | 117,106,823 |
| 1856 | 70,371,720 | 16,199,890 | 4,582,242 | 7,982,800 | 45,119,429 | 144,256,081 |
| 1857 | 86,255,079 | 8,137,360 | 2,685,300 | 11,892,120 | 49,091,510 | 158,061,369 |
| 1858 | 88,127,340 | 17,900,608 | 4,601,015 | 13,628,327 | 42,798,256 | 167,155,546 |
| 1859 | 92,037,794 | 24,998,424 | 6,470,817 | 9,161,750 | 40,283,879 | 172,952,669 |
| 1860 | 109,389,228 | 18,190,880 | 6,250,335 | 8,499,325 | 42,881,486 | 185,211,254 |

[1] Report on Internal Commerce of the United States, 1887.

While the value of receipts at New Orleans during these years increased 93 per cent and while receipts of cotton increased 166 per cent, sugar 50 per cent, molasses 160 per cent, and tobacco about 33 per cent, both sugar and tobacco having been still higher in value in some of the intervening years, the value of "other products" increased only 26 per cent. These statistics do not show quantities, hence final conclusions can not be drawn from them, but they clearly show the tendency. During the years 1854–1858, western produce represented but 18 per cent of the total receipts at New Orleans as

compared with 61 per cent in the early years of river commerce.[1] Traffic in large quantities still continued to be handled on the Ohio between Cincinnati and Pittsburgh and between Cincinnati and St. Louis, and also to a considerable degree on the upper Mississippi as far south as St. Louis, but dependence upon New Orleans as a market was being gradually lessened.

The year immediately preceding the outbreak of the war, 1859–60, was the best year on the river for New Orleans. The city received the heaviest shipments and the steam river tonnage entered at the port was the largest ever recorded. There reached New Orleans that season by river 2,187,560 tons of freight, and the total river trade of the city was valued at $289,565,000.[1] The significant fact concerning this trade, however, was its comparatively local character. Of the total steamboat arrivals at New Orleans for the year 1859–60, amounting to 3,540, 1,835 were from the State of Louisiana and 576 from the neighboring States of Mississippi, Arkansas, and Texas. New Orleans had no railway worth mentioning in 1860, but the city controlled the entire river trade, commerce, and crops of the State of Louisiana. By means of the Red River, she secured a hold on the crops of northern Texas. The greater portion of Indian Territory, the larger part of Arkansas, all the Ouachita and Arkansas valleys, a portion of the White River trade running up into Missouri, were at the command of the Crescent City. The State of Mississippi was subject to New Orleans, except for its eastern portion through which the Mobile and Ohio Railroad now ran. Western Tennessee and a large portion of Kentucky still sent their products south, and probably one-fifth of the produce of the Ohio Valley and one-third of that of the upper Mississippi still found its way to New Orleans. But the significant thing was that the western produce then moving south was wholly for local consumption and not for export. It was to supply the planters with food products and supplies, in order that they might devote their attention exclusively to cotton raising. The export business in northern products had turned eastward.

The traffic of the Mississippi and Ohio rivers and their tributaries had been tapped at many points. Produce formerly traveling to New Orleans by flatboat from the upper Tennessee was now carried largely to Charleston, Savannah, and other seaboard cities. The receipts at New Orleans from northern Alabama were less in 1860 than in 1845, notwithstanding a steady gain in the prosperity of that section. At Cincinnati a large portion of the flour and grain formerly sent down the Ohio now went to Pittsburgh by river and thence by rail; or by canal to Toledo, and thence by lake and canal or rail to the seaboard, or to some slight extent "all rail." With the establishment at Galena of through connections with the east in 1855, the lead trade on the river which had gone via New Orleans to New York and Europe suddenly dropped off and soon disappeared altogether.

At Cincinnati, for the year 1857, there were received a total of 886,900 tons of merchandise, and there were shipped 528,110 tons, of which a little over 10 per cent in and out was handled by rail. This was an increase of 17 per cent in rail tonnage over the year previous. At Louisville, in 1857, 13 per cent of the flour, 8 per cent of the

[1] Report on Internal Commerce of the United States, 1887.

wheat, 29 per cent of the corn, 26 per cent of the whisky, and 10 per cent of the coffee were received by rail. At St. Louis, of the flour received in barrels 15 per cent came by rail in 1857, 27 per cent in 1858, and 33 per cent in 1859. Davenport, Iowa, the river terminus of the Mississippi and Missouri Railroad, opposite Rock Island, Ill., received in 1857 large quantities of lumber, shingles, railroad iron, coal, and corn by way of the Chicago and Rock Island Railroad, and wheat, pork, flour, and wool from the West by the Mississippi and Missouri Railroad. By way of the river the principal product received was lumber, which amounted to nearly twice that received by rail. The aggregate exports and imports for the year were estimated at 93,683 tons, of which 87 per cent was handled by rail. But Davenport had the first bridge across the Mississippi, and thereby had earlier secured rail connections with the East.

The following table, presenting the shipments of flour and grain in bushels from Chicago for a series of years, shows in a striking way the influence of railway extension westward from the city. It will be observed that in 1854, the first year of railway connection with the Mississippi River, the shipments were doubled.

*Total shipments eastward of flour and grain from Chicago, 1838–1863.*[1]

| | Bushels. |
|---|---|
| 1838 | 78 |
| 1839 | 3,678 |
| 1840 | 10,000 |
| 1841 | 40,000 |
| 1842 | 586,907 |
| 1843 | 688,907 |
| 1844 | 923,494 |
| 1845 | 1,024,620 |
| 1846 | 1,599,819 |
| 1847 | 2,243,201 |
| 1848 | 3,001,740 |
| 1849 | 2,895,959 |
| 1850 | 1,858,928 |
| 1851 | 4,646,591 |
| 1852 | 5,873,141 |
| 1853 | 6,422,181 |
| 1854 | 12,902,320 |
| 1855 | 16,633,645 |
| 1856 | 21,583,221 |
| 1857 | 18,032,678 |
| 1860 | 31,109,059 |
| 1863 | 54,741,839 |

These instances cited do not completely cover the extent and power of the railroad influence in the decade before the war, but it is unnecessary to go further into detail. The examples are typical of the situation.

The development of transportation agencies before 1860 may be summarized broadly by the statement that up to 1850 water routes, including the coastwise and gulf lines, constituted the principal ways of freight movement, while the business on the Lakes and interior rivers was increasing. Railways were preeminently passenger lines.

[1] Monthly Summary of Commerce and Finance, January, 1900.

Before 1850 railways in the East had begun to compete with the waterways, but, so far as they existed at all in the West, they were feeders to the water lines. Competition with the waterways of the Mississippi Valley came from the water route formed by the Hudson, Erie Canal, and Lakes, with the cooperation of short railway feeders. But in the decade 1850–1860 railways made a good beginning toward the assumption of that competitive relationship which was soon to prove so disastrous to the water lines. In some instances the competition by 1860 had become so serious as to endanger the existence of river traffic.

# DECLINE OF RIVER COMMERCE AFTER 1860.

## I.

### THE WAR AND THE RAILWAYS.

The war served at once to close all southern ports to commerce, and destroyed the greater part of the river trade. Steamboats continued to a small extent to ply the waters of the upper Mississippi and the Ohio, but through traffic southward ceased altogether. Railway building continued. The rail lines which most seriously threatened river commerce were located north of the Ohio, and were undisturbed by military operations. Although hampered by lack of capital, extension of lines was not wholly checked, and the progress in railway building made during the time of disturbance was sufficient to increase materially their competitive power. Bridges across the Mississippi and Ohio were authorized by Congress in 1866, and the connections between the two banks of the river were soon thereafter made. The building of the Union Pacific gave an added impetus to the westward moving railways, all of which were eager for this transcontinental connection. The Union Pacific was opened in 1869. In 1867 the Chicago and Northwestern and the Chicago, Burlington and Quincy controlled lines reaching to the Missouri River. In 1869 the Chicago, Rock Island and Pacific was running through trains from Davenport to Council Bluffs, and early in 1870 the Illinois Central was operating under lease a line from Dubuque to Sioux City. In 1867 a line was completed from Milwaukee to St. Paul via Prairie du Chien. The Pacific Railroad of Missouri was completed from St. Louis to Kansas City in 1865. Farther south, where the ravages of war were more severe, progress was naturally slower. Mobile and New Orleans were united by rail in 1870, and in 1874 a continuous line had been formed from Chicago to New Orleans paralleling the Mississippi by the extension northward to join the Illinois Central at Cairo of the New Orleans, Jackson and Great Northern and the Mississippi Central.

The following table shows the growth in railway mileage from 1851 to 1868 in the States bordering the rivers. It will be observed that in all except the Southern States there was railway building during the war period, and that in some cases, notably Illinois, Iowa, and Ohio, the progress from 1860 to 1865 was remarkable.

*Total number of miles of railway in designated States, 1851–1868.*

| State. | 1851. | 1855. | 1860. | 1865. | 1868. |
|---|---|---|---|---|---|
| Ohio | 638 | 1,486 | 2,946 | 3,331 | 3,398 |
| Indiana | 86 | 1,406 | 2,163 | 2,217 | 2,600 |
| Illinois | 116 | 887 | 2,790 | 3,157 | 3,440 |
| Minnesota | ..... | ..... | ..... | 213 | 572 |
| Wisconsin | ..... | 187 | 905 | 1,010 | 1,235 |
| Iowa | ..... | 68 | 655 | 891 | 1,523 |
| Missouri | ..... | 139 | 817 | 925 | 1,354 |
| Kentucky | 93 | 242 | 534 | 567 | 813 |
| Tennessee | ..... | 466 | 1,253 | 1,296 | 1,436 |
| Arkansas | ..... | ..... | 38 | 38 | 86 |
| Mississippi | 60 | 278 | 862 | 898 | 898 |
| Louisiana | 50 | 203 | 335 | 335 | 335 |
| Kansas | ..... | ..... | ..... | 40 | 648 |
| Nebraska | ..... | ..... | ..... | 122 | 920 |

During this period of waterway inactivity the railways were not only extending their lines, but they were making more efficient their existing facilities. Consolidation of connecting lines into single systems for the purpose of increasing the efficiency of long-distance operation was proceeding rapidly. In the sixties appeared the first of the fast freight lines, which facilitated enormously the handling of through business from the West. Cooperation of railways in the construction of union stations, connecting tracks, and similar facilities increased in the decade 1860 to 1870. It is interesting to observe that one of the causes assigned for the building of cars by shippers was the fear of the railways that the restoration of river business after the war would have such a serious effect upon their business that it would be unwise for them to make the necessary outlay themselves. The fact that northern agricultural production actually increased during the war[1] and that there was a growing demand in Europe for our breadstuffs were favoring conditions. Shippers became accustomed to the new transportation agency. They found it more efficient, and it relieved them of the burden of marine insurance. In short, business relationships were established which carried over after the waterways were again available, and, except at certain periods when circumstances were exceptional, the rivers did not even approach their former position of importance.

The consolidation of connecting railway links had given the eastern trunk lines control of their western connections, and with it the power to reach out to the source of traffic and control its transit. By the end of the sixties, the railways had gained a considerable degree of confidence in their ability to compete with western rivers and lakes. In 1869 it was said that grain could be moved by rail from St. Louis to the north Atlantic seaboard for a much smaller sum than the usual rate for carrying it from St. Louis by steamboat to New Orleans. In 1872 the railways carried to market 83 per cent of the grain and provisions of the West.[2] The overland movement in cotton, which had amounted in 1852 to only 175 bales, reached 109,000 bales in 1860, 350,000 in 1870, and 1,134,000 in 1880. When business was resumed on the river in 1865 the Cincinnati Price-Current estimated the decline in the shipment of western produce south by river at from 75

[1] Shipments of flour and grain from Chicago east increased from 31,000,000 bushels in 1860 to 55,000,000 bushels in 1863. See table, p 35.
[2] Ringwalt, op. cit., p. 191.

to 90 per cent, the produce still shipped in this manner being for local consumption only. The diversion of commerce from river to rail at St. Louis was aided by the fact that in river traffic transfers at this point were necessary. Because of the shallowness of the upper river, vessels of much less draft operated above the city than below. Because of this break in shipment, the railways found their opportunity to step in and take the business.

Passengers naturally sought the more rapid means of travel, and the passenger steamboat, which had played such a part in the settlement of the West, began after the war to diminish in importance. Passenger transportation is now confined to excursion trips southward in the winter and northward in the summer, and to ferry and short-distance local service. Steamboats have since 1860 been constructed with special reference to the carrying of freight. Since the war, also, has appeared on a larger scale the towboat, or propelling steamer, built with powerful engines, stern wheel, and shallow draft, to handle the tows of barges, flats, or rafts. It has been a factor in the development of the coal trade of the Ohio River, it played a necessary part in the development of the barge line between St. Louis and New Orleans, and it has been and is still regularly engaged in the declining rafting operations of the upper Mississippi. Its stern wheel gives it peculiar facility in backing and turning and in handling its tows and rafts successfully around the innumerable sharp bends in the rivers. The barge became employed extensively as a freight carrier, because the shallow depth of the rivers made a development of steamboat capacity with vessels of deep draft an impossibility. It was necessary to devise a shallow craft which could spread out over the water and which could be loaded above the water line rather than below decks. By this change in transportation methods a very great reduction in cost was obtained.

With the exception of the civil war, there was probably no single influence which played so large a part in diverting traffic from the lower Mississippi to the railways as the condition of the mouth of the river. So long as exports from New Orleans were carried in clipper ships with sharp keels which drew when loaded not more than 16 to 18 feet, there was a reasonable probability that they could get over the bar in Southwest Pass with the aid of towboats. Doubtless the poor channel diverted some commerce from this port, yet the demand for cotton abroad led vessels to make special effort to reach New Orleans, and commerce at this port continued to grow. But with a change in build and size of shipping seeking the port, the shallow entrance became impracticable. When there was added to this the unreasonable charges and the arbitrary regulations of a monopolized towboat company, the situation became intolerable. It was not relieved until 1877, when the Eads jetties at South Pass were completed. Towing charges and insurance rates both fell at once, and the dangers of stranding and the costs of delay were no longer to be feared. There have been other physical difficulties also in the way of the development of lower Mississippi commerce. Aside from those due to a shifting channel and the presence of snags, ice and low water have been constant hindrances. Between St. Louis and Cairo, navigation has been regularly suspended for a greater or less time each year because of ice. The average number of days of interruption per year for the ten years 1871 to 1880 was thirty-five. A

more serious interference over this same stretch has been the frequent low water, due both to lack of water supply and to the sediment brought down by the Missouri. The full advantages of river commerce can not be attained unless boats which draw 8 feet of water when loaded can be employed. At times vessels drawing only 4 feet could alone be used at what is estimated to have been double the cost. The Select Committee of the Senate on Transportation Routes to the Seaboard found that during the nine years 1865 to 1873 the average number of days in which the water was less than 8 feet was one hundred and fifty nine. For the ten years 1871 to 1880 the average was one hundred and twenty-six days. From 1900 to 1909, however, dredges have continuously maintained an 8-foot depth during the navigation season. Below Cairo a 9-foot navigation is seldom obstructed by either ice or low water. The frequently reiterated charge that certain kinds of products were injured by the climate of New Orleans, and that this had led to a diversion of traffic eastward, was investigated by the Select Committee on Transportation Routes to the Seaboard in 1874, and found to have no legitimate basis except, possibly, to some slight extent in the case of corn.

The passage of the interstate-commerce act in 1887 aroused the well-nigh forlorn hope of the steamboat interests. These interests, as a rule, had not been able to raise their rates because of the sharp competition of individual steamboat owners. They had watched the railways lower their rates at competitive water points until they had taken the business, and then, to some extent, at any rate, recoup themselves by higher exactions from shippers at inland points which had no water facilities. The interstate-commerce law forbade discrimination, and complaints were promptly presented to the commission with reference to the river situation. But two months after the passage of the act the commission rendered a decision in the petition of the Louisville and Nashville Railroad and others, relieving the roads from the necessity of conforming to the long and short haul clause where water competition was present. With this decision went the last hope of the steamboat men that they could maintain themselves against the superior service of the railways, and orders for new steamboats, which had been held up awaiting the commission's action, were canceled.

## II.

### OHIO RIVER COMMERCE.

As the Ohio River Valley had earliest developed its waterway as an efficient transportation agency, so it was the first to be influenced by the extension of railways. By 1875 the four leading east and west trunk lines with western connections at Chicago, St. Louis, Louisville, and Cincinnati had become the important commercial highways, and had greatly influenced the course of trade in the States south of the Ohio and of Missouri. The commercial centers of this section were now St. Louis, Louisville, and Cincinnati, in competition with Mobile, New Orleans, and Galveston. The three former drew their supplies principally from Atlantic seaports. By 1880 Cincinnati had realized the futility of the waterway as an aid in the competitive struggle, and in that year had completed her Cincinnati Southern Railway to Chattanooga with the purpose of securing a grip on southern territory.

Competition between the two forms of transportation had a steadying effect upon water rates. The river rates had earlier been determined wholly by the supply of and demand for transportation, and this had been influenced greatly by the condition of navigation. But by 1870 it appeared that an enhancement of the water rate during a season of low water had a tendency to divert traffic to the railway, and that the boats could therefore no longer enjoy the full benefit of their situation. To some extent, agreements for prorating on through traffic were entered into between rail and water lines. For example, the Chesapeake and Ohio prorated with Ohio steamboats on an allowance of two miles of waterways for one of rail. These agreements, however, were difficult to arrange and to keep in force because of the lack of boating organization and the necessity of making contracts with so many individual steamboat owners. Nevertheless, prorating arrangements between railways and the packets operating on the Ohio for the purpose largely of handling Pittsburg steel products continued until about 1900, when they were terminated in response to the desire of railways serving the Pittsburg district.[1]

The gradual absorption of the general merchandise traffic of this whole section by the railways may be illustrated in the commercial development of Cincinnati. The trade of this city was until about 1860 chiefly dependent upon the Ohio River and its connections, except for that portion of its products which went north by canal and the Lakes. The outbreak of the war arrested the commerce of Cincinnati, and the diversion of traffic to the railways, following upon the restoration of normal industrial conditions, not only made Louisville and St. Louis more active competitors of Cincinnati than before, but also brought Chicago into the field as a powerful rival. The river trade was inactive from 1861 to 1872, the down-river traffic below Louisville being limited by the capacity of the Louisville and Portland Canal, which admitted only boats of a maximum capacity of 600 to 700 tons. In that year, however, the enlarged canal was completed. Two years later the tolls were reduced and in 1880 were abolished altogether. These improvements made possible the employment of boats of 1,700 tons upon an unimpeded river and gave some impulse to river commerce. But so rapidly did traffic on the Ohio decline that by 1887 there was but one regular steamboat line between Cincinnati and New Orleans. No boats ran from New Orleans to the Cumberland and Tennessee rivers, and there was no regular Louisville boat.

The following table of Cincinnati exports shows the steadily increasing preponderance of rail traffic:

*Exports from Cincinnati, 1855–1880.*[2]

| Year ending August 31— | Shipped by river. | Shipped by rail and canal. |
|---|---|---|
| 1855 | $20,733,234 | $18,044,160 |
| 1865 | 77,498,017 | 116,292,294 |
| 1875 | 43,832,099 | 157,571,924 |
| 1880 | 45,537,667 | 208,289,600 |

[1] Report of Commissioner of Corporations on Transportation by Water, Part II.
[2] Report on Internal Commerce of the United States, 1880.

The shipments by canal were a small and declining amount, and the large proportion of shipments shown in the second column were handled by the railways.

These same tendency may be also illustrated by a table of steamboat arrivals at Cincinnati for a series of years.

*Number of arrivals of steamboats at Cincinnati, 1848–1880.*

| Year. | From New Orleans. | From Pittsburg. | From St. Louis. | From other ports. | Total. |
|---|---|---|---|---|---|
| 1848 | 319 | 880 | 292 | 2,499 | 3,780 |
| 1855 | 159 | 407 | 210 | 1,809 | 2,585 |
| 1860 | 185 | 330 | 206 | 2,264 | 2,985 |
| 1865 | 41 | 211 | 111 | 3,127 | 3,490 |
| 1870 | 107 | 151 | 115 | 2,339 | 2,712 |
| 1875 | 71 | 62 | 27 | 2,442 | 2,602 |
| 1880 | 103 | 182 | 93 | 2,785 | 3,163 |

The only arrivals in which there has not been a sharp decline are those from "other ports," which consist, principally, of local and ferry service.

The following table gives the steamboat traffic out of Cincinnati for the years 1855 and 1905, and shows its change in character and its marked decline. The comparison is disturbed, but not wholly destroyed, by the variety of units of measure employed:

*Principal shipments by river from Cincinnati, 1855 and 1905.*

[Compiled from reports of Cincinnati Chamber of Commerce and Merchants' Exchange.]

| Article. | | 1855. | 1905. |
|---|---|---|---|
| Ale, beer, and porter | barrels | | 9,523 |
| Alcohol | do | 19,956 | |
| Apples, green | do | 3,427 | 3,004 |
| Beef | do | 17,584 | |
| Do | tierces | 13,977 | |
| Beans | barrels | 1,297 | |
| Brooms | dozens | 18,275 | |
| Butter | barrels | 1,300 | |
| Do | tubs | | 440 |
| Do | firkins, kegs | 24,196 | |
| Butterine | pounds | | 56,630 |
| Bran, etc | sacks | 11,456 | |
| Bagging | pieces | 2,485 | |
| Cattle | head | 10,285 | 916 |
| Candles | boxes | 131,191 | |
| Castings | pieces | 80,263 | |
| Do | tons | 2,073 | 231 |
| Cement and plaster | barrels | | 3,591 |
| Cheese | casks | 4 | |
| Do | boxes | 102,352 | 7,615 |
| Coffee | bags | | 10,079 |
| Do | sacks | 42,283 | |
| Cooperage | pieces | 108,105 | 11,083 |
| Corn | bushels | | 8,042 |
| Do | sacks | 64,344 | |
| Corn meal | barrels | 2,772 | |
| Cotton | bales | 10,021 | 127 |
| Crockery | packages, cases, etc | | 2,846 |
| Eggs | barrels | 5,014 | |
| Do | cases | | 3,151 |
| Feathers | sacks | 7,319 | |
| Do | pounds | | 3,300 |
| Flour | barrels | 199,276 | 6,663 |
| Fruit, dried | pounds | | 93,000 |
| Do | bushels | 13,029 | |
| Fresh meats | pounds | | 11,400 |
| Furniture | packages | | 17,723 |

*Principal shipments by river from Cincinnati, 1855 and 1905*—Continued.

| Article. | | 1885. | 1905. |
|---|---|---|---|
| Glass, window | boxes | | 1,872 |
| Glassware | packages | | 37,092 |
| Hardware | do | | 30,845 |
| Grease | barrels | 9,413 | |
| Hay | tons | | 189 |
| Do | bales | 5,706 | |
| Hemp | do | 2,918 | |
| Hides | number | 24,427 | 3,628 |
| Do | pounds | 44,035 | |
| Horses | head | 1,630 | 1,384 |
| Hogs | do | | 331 |
| Hog products: | | | |
| Bacon | pounds | | 524,215 |
| Hams | do | | 329,310 |
| Dry salted meats— | | | |
| Loose | do | | 40,900 |
| In boxes | do | | 1,056,500 |
| Lard | do | | 1,000,037 |
| Do | barrels | 43,799 | |
| Do | kegs | 62,806 | |
| Pork | barrels | | 103 |
| Do | bulk | 873,054 | |
| Pork and bacon | hogsheads | 42,469 | |
| Do | tierces | 40,515 | |
| Do | barrels | 104,275 | |
| Do | boxes | 22,574 | |
| Lard oil | barrels | 43,595 | |
| Iron | pieces | 604,861 | |
| Do | bundles | 63,716 | |
| Do | tons | 11,978 | [1] 1,509 |
| Leather | bundles | | 2,170 |
| Linseed oil | barrels | 3,454 | |
| Lumber | square feet | | 75,000 |
| Manufactures, sundry | pieces | 347,564 | 5,228 |
| Merchandise, sundry | tons | 8,466 | 16,656 |
| Do | packages | 811,625 | |
| Molasses | barrels | 45,150 | 431 |
| Nails | kegs | | 5,399 |
| Oil cake | tons | 78 | |
| Oats | sacks | 42,282 | |
| Do | bushels | | 9,969 |
| Oil | barrels | | 5,394 |
| Potatoes | do | 10,399 | |
| Do | bushels | | 18,025 |
| Petroleum | barrels | | 979 |
| Produce, sundry | packages | 141,925 | |
| Rice | barrels | | 588 |
| Rye | bushels | | 2,760 |
| Rope, twine, etc | packages | 3,909 | |
| Shoes and boots | cases | | 12,944 |
| Salt | barrels | 36,333 | 7,576 |
| Do | sacks | 9,606 | |
| Seed: | | | |
| Clover and timothy | bags | | 4,577 |
| Grass | barrels | 7,330 | |
| Flax | do | 1,121 | |
| Sheep | head | 1,650 | 651 |
| Soap | boxes | 34,247 | |
| Sugar | hogsheads | 32,432 | |
| Do | barrels | | 3,693 |
| Starch | boxes | 24,520 | |
| Sundry liquors | barrels | 25,714 | |
| Tallow | do | 6,893 | |
| Tobacco | kegs and boxes | 26,077 | |
| Do | hogsheads | 4,968 | |
| Do | bales | 3,307 | |
| Tobacco leaf | hogsheads | | 4,186 |
| Do | cases and bales | | 48 |
| Tobacco, manufactured | packages | | 2,158 |
| Vinegar | barrels | 8,643 | |
| Wheat | bushels | | 8,258 |
| Whisky | barrels | 243,551 | 13,914 |
| Wool | bales | 6,435 | 603 |
| Do | pounds | 4,482 | |
| White lead | kegs | 55,218 | |
| Wines and liquors | barrels | | 1,266 |
| Do | boxes and baskets | | 11,437 |

[1] Iron and steel.

The commodity predominant in Ohio River commerce, in fact the only commodity of importance now transported on the Mississippi River system, is bituminous coal. For over twenty-five years this has far surpassed all other commodities in tons carried. For the sixteen years 1886 to 1902 the total amount of freight carried through the Louisville and Portland Canal was about 31,000,000 tons, of which nearly 75 per cent was coal.

Transportation of this commodity began very early in the nineteenth century with the aid of the flatboat already described. But the dangers of the upper Ohio in a "rise" and the difficulties of navigation in low water made the floating of coal flats too precarious to be profitable. Ohio River coal handling assumed importance about 1850, when steam towing or, better, propelling was permanently introduced, and the business was extended beyond the Ohio River itself as far as New Orleans. This traffic on the Monongahela has steadily increased because of the extraordinary cheapness with which it can be handled, and it alone has saved river commerce in this section from destruction. While the size of craft employed and the efficiency of propelling steamboats have been increased, there has been no fundamental change in the method of handling the traffic during the last quarter century. There are three typical craft employed, which are, in the order of size, the coal boat, the barge, and the flat or float. The coal boat, drawing 10 feet of water, has a capacity of over 1,000 tons or 25,000 bushels. It costs about $800, and was formerly commonly sold with its cargo at destination. The barge, with a little less draft, has about half the capacity of the boat, but is better built, costs about $1,000, and is returned empty for reloading. This is used more commonly in the trade which does not extend beyond Cairo or St. Louis. The float or flat is a still smaller craft, of about 200 tons or 5,000 bushels capacity, drawing about 4 feet, and costing $400. This fragile craft has also commonly been broken up at the end of its voyage. These three kinds of floating equipment, together with fuel boats and the steam towboat, constitute the fleet.

The method of handling as the fleet proceeds downstream is simply that of a progressive accumulation of units into larger aggregates, as navigation grows more reliable. The origin of the traffic is on the Monongahela River, where the coal is now loaded mechanically from the mines into the barges. However, the coal has always been in sufficiently close proximity to the waterway to make water handling profitable, even before the introduction of mechanical aids. At the beginning of the coal business, flats and rafts were floated down the river at high and medium stages of water. The river was first improved by a private company, incorporated by the State of Pennsylvania in 1836, whose works were acquired by the United States in 1897. The river is now navigable by means of locks to Fairmont, W. Va., 131 miles above Pittsburg. Coal is propelled down this river in small tows to Pittsburg Harbor where the boats and barges are moored awaiting a favorable stage of water, when they are sent in large aggregates to points below on the Ohio and Mississippi. Fleets of 25 boats, barges, and flats containing 350,000 to 500,000 bushels of coal are now handled from Pittsburg to Louisville. There they are moored above the falls of the Ohio at Jeffersonville, Ind., are towed in sections through the Louisville and Port-

land Canal, or entire over the falls as the stage of water determines, and are reassembled below the falls into still larger fleets for the final stretch of their journey. One of the largest fleets recorded carried from below the falls 56,000 tons, or 1,400,000 bushels of coal.

The rapid increase in this traffic in the eighties was due, so far as southern demand was concerned, partly to the rapid growth of manufacturing at New Orleans and other Louisiana and Mississippi points reached by the river and its tributaries, and partly to the demand for coal in the Louisiana sugar houses. Nine-tenths of the Louisiana sugar plantations were then on the bank of some stream, and coal could be delivered to them directly by water in these shallow barges. This coal is still used by the sugar and rice mills of Louisiana. It is also in demand in the gas, domestic, and steam coal trade of New Orleans, by coastwise and ocean steamships, and by railway locomotives. None of it is used at any distance from the river bank; none is sent for sale to domestic ports beyond New Orleans. Of the total annual receipts at New Oleans of about 1,000,000 tons, about 500,000 tons are used by ocean steamships, and about 400,000 tons are unloaded on the west bank of the river largely for railway use.

Coal is now landed to some extent at important points along the river system, such as Cincinnati, Louisville, Memphis, Vicksburg, Natchez, and Baton Rouge. Moreover, the coal barge furnishes a most satisfactory and economical method of providing the river steamers with fuel. The old picturesque method of "wooding up" disappeared with the exhaustion of the wood supply, and barges of coal are now moored to the river banks at designated points. These the steamers pick up, unload while in motion, and then moor again to the bank, where they are afterwards collected by the towboats and assembled for the return trip to Pittsburg. With the exhaustion of the timber supply of the Allegheny River, and the necessity of obtaining lumber from the Pacific coast, the coal barges are being returned to the mines in larger numbers, and less of them are being sold with the cargo.

The perfecting of this method of coal transportation has kept always in mind as the one object the attainment of the greatest possible economy of service. This has been accomplished by the use of propelling boats which do not attempt to make great speed, but which have the power to guide the huge unwieldly fleet of barges safely to their destination, and also by the method of spreading out the cargo over a wide area by means of craft as shallow as possible, in order to minimize low-water difficulties. As a result, coal is carried from Pittsburg to New Orleans at a little less than half of 1 mill per ton-mile, a rate which is quite beyond the reach of railway competition.[1] The development of the upper river business in coal may be shown, approximately, by the following table, which gives for the years 1844 to 1886 the number of bushels of coal and slack shipped from the Monongahela according to the books of the Monongahela Navigation Company, and from 1890 to 1907 the number of bushels passed through the locks of the Monongahela River, as shown by official reports.

[1] In view of the fact that the same corporation owns the mine, the loading and unloading facilities, the boats and barges, and to some extent the wharves, this rate is a mere matter of bookkeeping, and too much reliance should not be placed upon it.

*Coal and slack shipped from the pools of the Monongahela slack water, 1844–1885.*[1]

| | Bushels. |
|---|---|
| 1844 | 737,150 |
| 1850 | 12,297,967 |
| 1855 | 22,234,009 |
| 1860 | 37,947,732 |
| 1865 | 39,522,792 |
| 1870 | 57,596,400 |
| 1875 | 63,707,500 |
| 1880 | 84,048,350 |
| 1885 | 82,459,050 |

*Movement of coal through Monongahela River locks, 1890–1907.*[2]

| | |
|---|---|
| 1890 | 116,302,600 |
| 1895 | 104,589,900 |
| 1900 | 145,446,575 |
| 1905 | 212,233,500 |
| 1907 | 257,086,500 |

It is unnecessary to follow statistically the water traffic in coal from port to port down the river, but the following summary of the business of 1907 is illuminating. In that year there passed through Lock No. 3 on the Monongahela River, which is approximately the total coal traffic at its origin, 8,957,712 short tons. There was received in the Pittsburg district in this year from the Monongahela locks 6,840,816 tons, a small portion of this being mined within the pools between the locks, and hence not included in the first figure. There passed Davis Island Dam on the way down the river 2,883,965 tons. There was received at Cincinnati from the Monongahela River 1,244,720 tons, and a slightly smaller quantity from the Kanawha and other river sources. Through the Louisville and Portland Canal and over the falls of the Ohio at Louisville, there passed 1,154,991 tons on their way to destinations farther south. The receipts by river of coal at New Orleans are estimated at about 1,000,000 tons per year.

While the coal traffic has steadily grown, as already indicated, the growth during the last ten years has been almost wholly in the section between the mines and Pittsburgh and Cincinnati. Below Cincinnati there has been no marked change in river traffic during this decade. Moreover, it is not to be assumed that this product is handled exclusively or even predominantly by water. For example, of the total coal shipped into and through the Pittsburgh district during the years 1900 to 1906, the railways handled an average of 71 per cent and the waterways 29 per cent. For the Pittsburgh district alone, however, a larger proportion has always been received by water. In 1906 the proportion carried by water to Pittsburgh was 57 per cent, while to the territory west of Pittsburgh it was only 11 per cent. At Cincinnati, where the receipts consist almost wholly of bituminous coal from the Monongahela and Kanawha rivers, the proportion of coal received by river fell from 93 per cent in 1880 to 60 per cent in 1895 and 33 per cent in 1906. Of the total shipments out of Cincinnati in 1906 only about 6 per cent went by river. It is impracticable to ship coal in any quantity by water to St. Louis, and only a small amount, used for gas-making purposes, is brought in from Pittsburgh by river.

[1] Report on Internal Commerce of the United States, 1887.
[2] Monthly Summary of Commerce and Finance.

Passing from coal to other important sources of traffic, a brief summary of the report of the Commissioner of Corporations on Transportation by Water in the United States will suffice to present the existing situation. Of the traffic above Pittsburgh, that on the Allegheny is reduced to bulk freight, as railways parallel the river and handle general merchandise. This freight consists principally of lumber, a rapidly decreasing quantity, rafted downstream, coal carried a short distance upstream for the use of steel mills, and gravel, sand, and stone dredged along the river and carried to points in Pittsburgh Harbor. The total traffic amounted to about 2,500,000 tons in 1906. The Monongahela is likewise paralleled by railway lines, which take care of the merchandise business. Of the traffic outside of coal, the only products of importance are sand and gravel, of which the predominant movement is upstream. Coal constituted 84 per cent of the traffic in 1907 and sand and gravel nearly 15 per cent. Of the commerce of Pittsburgh Harbor in 1907, 75 per cent consisted of coal and 22 per cent of sand and gravel. Small shipments of iron and steel products still take place. Of the total commerce up and down stream at Davis Island Dam below Pittsburgh in 1907, 80 per cent was coal. Sand was next in order, with 17 per cent of the total tonnage. At Wheeling the total receipts and shipments by river for the year 1906 amounted to only 161,550 tons, mostly general merchandise. The Muskingum River has a small miscellaneous traffic of little importance. Down the Little Kanawha are floated saw logs and railroad ties, which nearly absorb the entire tonnage. The total traffic of this river does not reach 100,000 tons annually. Of the traffic of the Kanawha, nearly 90 per cent in 1906 consisted of coal shipped almost wholly to Cincinnati. Timber and railroad ties are the other products of importance. The Big Sandy River had a traffic in 1906 of 205,452 tons, of which 94 per cent consisted of timber and ties. The Census Report on Transportation by Water in 1906 shows river receipts at Cincinnati of 2,131,847 tons and shipments of 231,368 tons. Some traffic is found on the Kentucky River, consisting principally of lumber and loose logs, and to some extent of coal, but the total amount is not large. At Louisville, according to the Census Report on Transportation by Water in 1906, the river receipts were 1,116,955 tons and the shipments 86,772 tons. Coal constituted more than half of the receipts, stone and sand being important items.

Through the Louisville and Portland Canal and by way of the open river in good stages of water the river traffic moves southward. Of the total tonnage passing Louisville by these two avenues in 1907, 88 per cent was coal. The other items of sufficient importance to be separately mentioned were iron ore, manufactured iron, and lumber. At Evansville, according to the Census Report on Transportation by Water in 1906, the river receipts, consisting principally of coal and lumber, amounted to 358,371 tons and the shipments to 57,762 tons. The Green and Barren rivers have a small tonnage, composed largely of timber and ties and some coal. The Cumberland River, although navigable for 500 miles, has a total tonnage not to exceed 600,000 tons, consisting largely of forest products, especially railroad ties. The Tennessee, navigable in the main river for 1,300 miles, had a tonnage in 1906 of 1,578,760 tons, consisting principally of iron ore and sand transported locally.

The census figures show a total traffic on the Ohio system of 15,797,000 tons in 1889 and of 15,227,000 tons in 1906. The decline in miscellaneous traffic and in lumber is offset by the increase in coal movement, so that according to the report of the Commissioner of Corporations on Transportation by Water in the United States the volume of traffic, with lumber, sand, and coal included, seems to have increased to some extent. But the striking characteristic of the commerce of this valley is the comparative lack of through business to the lower Mississippi which characterized it during the first seventy years of the nineteenth century. With the exception of coal and to a slight extent lumber, commerce is now confined to short-distance movements between local points. In spite of the fact that along the Ohio River between Pittsburg and Cairo there are forty railway crossings or terminals, this local traffic reaches back but a few miles from the river bank. Traffic requiring transfer and a rail haul of any considerable distance no longer makes any use of the river, but is handled the entire distance by rail.

## III.

### UPPER MISSISSIPPI COMMERCE.

It will be recalled that previous to the civil war the upper Mississippi was the sole highway into the Northwest and that freight and passenger traffic by water developed extensively. After railways reached the river in 1854 and 1855, close relations were established between rail and river, and pioneers and their supplies traveled by this avenue to their destination. But after the war the upper river was soon parallel by railways, and lines were also extended northwestward from Chicago and Milwaukee direct to Minnesota and Wisconsin river points. This promptly put an end to the steamboat passenger business and began the transformation of the freight traffic into a purely local trade.

Moreover, these railway lines tapping the river at so many points served as efficient distributing agencies for traffic brought down the river by steamboats, and this had its influence toward the destruction of through river trade. For example, of the southbound river tonnage which passed the bridge at Dubuque in 1878 more than half was stopped at Fulton and Rock Island and transferred to railways for shipment to Chicago.[1]

The building of railways west of the river already described had brought that vast territory almost completely into subjection to rail transportation. By 1879 seven-eighths of the surplus products of the trans-Mississippi States north of Arkansas crossed the Mississippi River on railways at St. Louis or between that city and St. Paul, and was transported east to local or foreign markets. Only 608,555 tons were moved south by river in 1878, as compared with 4,583,844 tons moved east by rail by way of St. Louis and points north, from the territory west of the Mississippi. During 1878 the eastward shipments from St. Louis by rail exceeded the southern shipments from that city by river.[1]

[1] Report on Internal Commerce of the United States, 1879.

This tendency to divert traffic from the waterway was accentuated by the long suspension of upper Mississippi navigation during the winter months, by the variations of the stage of water, and by the lack of facilities for adequate mechanical and commercial handling of products at river points. It was not surprising that sellers of western produce should prefer to send their shipments to Chicago rather than to some river town which had no wharves or docks, no warehouses, no unloading machinery, and no credit or banking facilities beyond what was necessary to meet a narrow local demand. Not only in floating equipment on the rivers, but in all mechanical aids and in all the various devices of organization that assist commercial exchange, the river system was totally lacking. In 1880 there were 13 railway bridges between St. Paul and St. Louis, and not a city with commercial power sufficient to divert traffic from its eastward course. Products once loaded in trains west of the Mississippi proceeded direct to Chicago and other large commercial centers, and water traffic declined.

The character of the traffic on the Mississippi and its tributaries during the ten years after the close of the war changed materially. As already noted, upper Mississippi River traffic, except lumber, to be later discussed, had been largely diverted from its southward course. On the lower Mississippi what remained to the steamboats consisted to a large degree of the lower classes of freight carried locally from point to point along the river. This traffic the railways had not cared to struggle for, but higher classes of freight from river towns, and practically all freight from the important interior centers in States south of Missouri and the Ohio River, were now moved their entire distance by rail.

It would hardly be worth while to trace in detail the decline in general-merchandise traffic, which began about 1870. Railway lines were extended on both banks of the river and at a distance back from the water, and were in a position to control all the merchandise traffic which they cared to handle. On the upper Mississippi, because of the uncertainty and brevity of the navigation season, water carriage has not to any great degree affected rail charges. Farther south, however, the railways have made special rates to divert river business.

General-merchandise traffic on the upper river is now wholly confined to the trading of small steamers between local points, except for such traffic as is handled by one passenger line between St. Louis and St. Paul, which is operated largely for excursion purposes. No one of the formerly important river towns, such as Burlington, Quincy, Alton, Davenport, Rock Island, Clinton, Dubuque, Lacrosse, and Winona, has any considerable river traffic to-day. As already stated, grain was carried before the war during the prosperous days of steamboating to the maximum capacity of the boats. This continued in diminishing quantities into the decade 1880–1890, some of it being transshipped by the barge line from St. Louis to New Orleans. But this has now ceased altogether. Wheat raised near enough to the river to make water handling possible and profitable is now consumed almost wholly by local mills. Conditions of navigation have discouraged flour shippers and that trade is at an end. Barge trade in merchandise freight does not exist on the upper Mississippi. According to the Census Report on Transportation by Water in 1906, the total

receipts and shipments of the upper Mississippi, exclusive of logs and rafts, amounted to 1,193,010 tons, of which 728,000 tons were stone and sand.

The growth of railway traffic in this section coincident with the decline of river traffic is shown by a comparison of business done in 1870 and 1880 by railways serving the Mississippi Valley, some of them paralleling the river, others crossing it.

*Table showing tons of freight carried and tons of freight carried 1 mile by certain western railways, 1870 and 1880.*

| Name of railway. | Tons of freight carried. | | Tons of freight carried 1 mile. | |
|---|---|---|---|---|
| | 1870. | 1880. | 1870. | 1880. |
| Chicago and Alton | 1,261,432 | 3,071,788 | 145,000,000 | 484,474,730 |
| Chicago, Burlington and Quincy | 1,052,754 | 6,639,186 | 147,409,207 | 1,624,461,793 |
| Chicago, Milwaukee and St. Paul | 1,522,753 | 3,260,353 | 181,428,573 | 504,876,154 |
| Chicago and Northwestern | 2,222,978 | 5,574,635 | 364,747,240 | 865,909,542 |
| Chicago and Rock Island | 856,668 | 2,966,763 | 130,683,871 | 686,458,954 |
| Illinois Central | 1,623,994 | 2,703,582 | 265,409,400 | 381,288,400 |
| Hannibal and St. Joseph | 411,831 | 716,739 | 70,858,854 | 120,665,740 |
| Ohio and Mississippi | 528,702 | [1] 1,284,254 | | |

[1] For the year 1876.

The traffic which during the most of this period used the upper river to the exclusion of the railway was that of logs and lumber of various kinds, which were floated loosely in the upper tributaries and then converted into rafts and propelled downstream to various points between St. Paul and St. Louis. Most of this traffic originated on the Wisconsin rivers, the St. Croix and Chippewa principally. Lumbering was carried on during the winter months, when snow made transportation for short distances to the rivers easy. In the spring, with the break-up of the ice, the logs were floated down these streams, and when they reached the navigable river, where guidance through the bridges was necessary, they were taken in charge by towboats. Every town of any size from St. Paul to St. Louis was either a lumber manufacturing and distributing point for the logs delivered to them or a mere distributing center for the rafts of laths, shingles, and various forms of manufactured lumber brought down from the mills on the upper river and tributaries. As early as 1876 there were 73 mills in operation on the main river between St. Paul and St. Louis.[1] Supplies of lumber were shipped from these points by rail from 10 to 100 miles east of the river, and from 500 to 1,000 miles west.

But even this source of traffic has been slowly slipping away. Whereas in 1876 there were 100 raft boats engaged in towing logs and lumber on the upper Mississippi, in 1906 there were only 20. Statistics of the amount of white pine now floated on the river are not available, but the estimated number of feet of logs, lumber, and shingles transported is here given for a series of years up to 1891. The wide variations in different years are due to conditions of navigation.

[1] Report on Internal Commerce of the United States, 1887.

*Number of feet of white pine floated on the upper Mississippi River (estimated).*

| | Feet b. m. |
|---|---|
| 1875 | 1,060,000,000 |
| 1876 | 1,350,000,000 |
| 1878 | 1,153,000,000 |
| 1880 | 2,000,000,000 |
| 1886 | 1,315,000,000 |
| 1891 | 1,240,000,000 |

The decline in this form of traffic is due in part to the conditions of navigation. Actual low water, the uncertainty of an adequate stage of water, and the delays due to log jams have diverted much traffic to the railways. It is doubtful, however, whether the short navigation season of Wisconsin and Minnesota has had any great influence, for the winter season has been admirably adapted for the primary lumbering operation. The most important cause of decline has been the exhaustion of the lumber supply along the river courses, making it more feasible either to ship logs by rail to the mills or to move the mills into the forests and ship out by rail the manufactured lumber. Capital for lumber manufacturing has for a decade been leaving the Mississippi Valley and engaging in southern and Pacific coast operations.

The following table presents the traffic through the government canal around the Des Moines and Keokuk Rapids from its opening in 1877 down to the present time. While different kinds of traffic vary in amount from year to year in accordance with conditions affecting the particular industry, and while the canal statistics do not show the entire traffic except in seasons when the water was too low for passage through the rapids, nevertheless a survey of the facts for the entire period shows strikingly the decline in the commerce of this section of the river.

*Traffic through the Des Moines Rapids Canal for a series of years from its opening in 1877.*

[Compiled from reports of United States engineers.]

| Year ending June 30— | Steamboats. | Barges. | Passengers. | General merchandise. | Grain. |
|---|---|---|---|---|---|
| | | | | *Tons.* | *Bushels.* |
| 1878 | 670 | 548 | | 53,346 | 737,415 |
| 1879 | 802 | 454 | 5,008 | 64,658 | 2,192,642 |
| 1880 | 967 | 651 | 13,231 | 78,989 | 2,197,469 |
| 1881 | 840 | 276 | 10,003 | 44,962 | 1,154,092 |
| 1882 | 760 | 444 | 8,588 | 29,043 | 781,817 |
| 1883 | 1,107 | 705 | 9,192 | 43,359 | 729,174 |
| 1884 | 913 | 245 | 13,057 | 54,215 | 470,580 |
| 1885 | 889 | 169 | 13,065 | 54,120 | 776,432 |
| 1886 | 784 | 218 | 22,221 | 56,001 | 465,681 |
| 1887 | 990 | 318 | 20,797 | 52,815 | 366,432 |
| 1888 | 595 | 235 | 8,330 | 33,160 | 143,037 |
| 1889 | 1,022 | 288 | 22,880 | 50,018 | 381,559 |
| 1890 | 924 | 477 | 14,529 | 71,453 | 397,788 |
| 1894 | 619 | 312 | 14,752 | 43,182 | 83,650 |
| 1895 | 606 | 340 | 14,141 | 22,035 | 55,729 |
| 1900 | 882 | 381 | 27,488 | 25,105 | 6,902 |
| 1905 | 928 | 285 | 33,906 | 14,451 | 3,700 |
| 1906 | 816 | 644 | 38,005 | 14,098 | 24,835 |
| 1907 | 999 | 144 | 48,825 | 13,849 | 12,271 |

*Traffic through the Des Moines Rapids Canal for a series of years from its opening in 1877*—Continued.

| Year ending June 30— | Logs. | Lumber. | Laths. | Shingles. |
|---|---|---|---|---|
| | *Feet.* | *Feet b. m.* | *Number.* | *Number.* |
| 1878 | ..... | 25,000,000 | 4,000,000 | 3,700,000 |
| 1879 | 8,086,000 | 33,347,612 | 8,721,796 | 11,749,500 |
| 1880 | 13,160,960 | 21,832,478 | 27,863,640 | 30,561,150 |
| 1881 | 11,013,410 | 52,256,235 | 11,657,655 | 15,091,000 |
| 1882 | 4,475,000 | 17,150,011 | 3,112,825 | 4,885,250 |
| 1883 | 1,040,000 | 13,093,325 | 11,558,000 | 4,435,000 |
| 1884 | 9,399,764 | 57,018,151 | 15,924,645 | 25,182,250 |
| 1885 | 2,779,670 | 43,119,797 | 13,473,205 | 25,018,750 |
| 1886 | 3,195,360 | 22,769,823 | 4,302,800 | 8,253,000 |
| 1887 | 24,827,000 | 178,754,876 | 19,961,781 | 90,450,922 |
| 1888 | 34,505,000 | 166,827,752 | 83,642,450 | 49,848,840 |
| 1889 | 26,333,320 | 118,508,045 | 50,221,099 | 37,413,810 |
| 1890 | 26,689,300 | 146,078,329 | 44,316,167 | ..... |
| 1894 | ..... | 117,360,783 | 42,112,415 | ..... |
| 1895 | 29,545,910 | 155,625,800 | 55,064,938 | 55,670,204 |
| 1900 | 32,142,550 | 78,857,657 | 18,502,200 | 24,564,771 |
| 1905 | 4,475,000 | 17,190,000 | 8,262,000 | 4,655,000 |
| 1906 | 425,000 | 3,622,000 | 637,000 | 400,000 |
| 1907 | 6,700,000 | 7,358,000 | 4,232,000 | 1,300,000 |

Of the traffic on the lower portion of the upper river that alone requires special mention which is handled on the Illinois River, mostly between St. Louis and Peoria. The total traffic on this river was given by the census in 1906 as 207,828 tons, of which the largest single item was grain. Of the two canals of this section which feed into the Mississippi the Hennepin Canal, which enters the river by way of the Rock River near Rock Island, was opened to navigation late in 1907 and handled in that year 3,742 tons of freight and 2,862 passengers. The Illinois and Michigan Canal from Chicago to La Salle is now partly replaced by the Chicago Drainage Canal, but the remaining portions of the earlier waterway control its depth and its commerce. Traffic on the Illinois and Michigan Canal, which in 1889 amounted to 917,000 tons, was only 6,470 tons in 1906.

## IV.

### ST. LOUIS.

St. Louis, constituting one terminus of most of the steamboat lines, has shared the fate of these lines in its river business. To make this decline clear, it is only necessary to present from the records of the St. Louis Merchants' Exchange the following statistics, showing at intervals the receipts and shipments of St. Louis by the different rivers and the total receipts by rail. It gives, moreover, a striking picture of the decline of Mississippi River commerce as a whole.

*Shipments and receipts of freight, in tons, at St. Louis, by rail and river, for specified years, 1871–1906.*[1]

[Compiled from St. Louis Merchants' Exchange reports.]

SHIPMENTS.

| Year. | Upper Mississippi. | Lower Mississippi. | Illinois. | Missouri. | Ohio. |
|---|---|---|---|---|---|
| 1871 | 78,967 | 477,976 | 10,936 | 44,438 | 112,652 |
| 1875 | 96,225 | 367,235 | 18,470 | 25,100 | 129,025 |
| 1880 | 55,200 | 813,080 | 9,935 | 16,415 | 135,300 |
| 1885 | 48,295 | 442,850 | 865 | 10,330 | 17,130 |
| 1890 | 22,547 | 543,805 | 3,620 | 10,035 | ..... |
| 1895 | 30,780 | 241,155 | 7,040 | 5,505 | ..... |
| 1900 | 36,675 | 187,385 | 5,020 | 1,225 | ..... |
| 1905 | 25,730 | 35,295 | 6,225 | 4,705 | ..... |
| 1906 | 36,000 | 34,905 | 7,835 | 3,565 | ..... |

RECEIPTS.

| | | | | | |
|---|---|---|---|---|---|
| 1871 | 236,887 | 313,211 | 146,000 | 72,579 | 101,673 |
| 1875 | 198,100 | 128,020 | 153,995 | 30,160 | 146,805 |
| 1880 | 226,095 | 223,925 | 155,605 | 59,025 | 214,195 |
| 1885 | 117,445 | 116,950 | 84,830 | 16,875 | 133,595 |
| 1890 | 128,960 | 222,075 | 22,770 | 21,350 | 102,500 |
| 1895 | 78,170 | 239,090 | 30,600 | 3,270 | 35,440 |
| 1900 | 50,070 | 274,445 | 20,905 | 2,725 | 2,700 |
| 1905 | 31,190 | 107,520 | 8,725 | 3,580 | 125,755 |
| 1906 | 31,140 | 106,670 | 14,550 | 2,485 | 160,120 |

SHIPMENTS.

| Year. | Cumberland and Tennessee. | Red, White, Arkansas, and Ouachita. | Total by river. | Total by rail. | Grand total. |
|---|---|---|---|---|---|
| 1871 | 2,534 | 42,995 | 770,498 | 959,882 | 1,730,380 |
| 1875 | 1,560 | 1,480 | 639,095 | 1,301,450 | 1,940,545 |
| 1880 | 1,315 | 6,160 | 1,037,525 | 2,755,680 | 3,793,205 |
| 1885 | 9,955 | 4,750 | 534,175 | 3,537,133 | 4,071,308 |
| 1890 | 15,675 | 6,180 | 601,802 | 5,270,850 | 5,872,712 |
| 1895 | 17,535 | 1,340 | 303,355 | 5,349,327 | 5,652,682 |
| 1900 | 15,275 | ..... | 245,580 | 9,180,309 | 9,425,889 |
| 1905 | 8,620 | ..... | 80,575 | 15,225,973 | 15,306,548 |
| 1906 | 6,880 | ..... | 89,185 | 17,672,006 | 17,761,191 |

RECEIPTS.

| | | | | | |
|---|---|---|---|---|---|
| 1871 | 9,875 | 4,176 | 884,401 | 2,298,321 | 3,182,722 |
| 1875 | 6,345 | 100 | 663,525 | 3,232,770 | 3,896,295 |
| 1880 | 15,015 | ..... | 893,810 | 6,096,524 | 6,990,384 |
| 1885 | 9,370 | ..... | 479,065 | 6,764,168 | 7,243,233 |
| 1890 | 33,135 | 132,940 | 663,730 | 9,969,291 | 10,633,021 |
| 1895 | 23,575 | 98,685 | 508,830 | 10,489,344 | 10,998,174 |
| 1900 | 87,825 | 73,340 | 512,010 | 15,375,441 | 15,887,451 |
| 1905 | 11,870 | 1,210 | 289,850 | 23,915,690 | 24,205,540 |
| 1906 | 10,935 | 1,770 | 327,670 | 27,292,617 | 27,620,287 |

[1] These figures exclude lumber, logs, and shingles handled in rafts.

St. Louis suffered seriously in her upper-river commerce from the diversion eastward by the railways of traffic from the various river points. As early as 1875, 90 per cent of the lumber product floated on the upper Mississippi was diverted before it reached St. Louis, and in 1874 this proportion reached 94 per cent. In 1871 the receipts at St. Louis from the upper Mississippi were three times the shipments, but in 1906 they were about equal in amount and insignificant in

quantity. The loss in river receipts of lumber from the upper Mississippi has been partly compensated for by the receipts of southern pine brought in barges from the Tennessee and the lower Mississippi, but the amount handled by rail is now far in excess of that by water. Shipments of lumber to interior points of consumption are now almost entirely by rail.

In contrast to business by way of the upper Mississippi, the shipments to the lower Mississippi until 1895 exceeded the receipts. This is largely due to development of the barge lines to New Orleans, which will be later described. This barge traffic, which was largely in bulk grain, ceased in 1903. River grain receipts are now entirely in sacks, handled by packet steamboats from points up and down the Mississippi, including also the Illinois and the Missouri Rivers. The total receipts by river in 1906 of wheat, corn, oats, barley, and rye were only 866,199 bushels. Almost no grain is now shipped from St. Louis by water. Of cotton receipts, less than 1 per cent in 1906 came by water. Commerce by way of the Illinois, Missouri, Cumberland, and Tennessee has declined to but a fraction of its former size, and that of the Red, White, Arkansas, and Ouachita rivers has disappeared altogether. The total receipts and shipments at St. Louis for 1906 of the first four rivers mentioned did not amount to 50,000 tons.

Shipments to the Ohio River ceased before 1890, but receipts from there still continue, amounting in 1906 to half the total river receipts. This was entirely coal from the Monongahela River. River commerce at St. Louis which in 1871 constituted 34 per cent of the total rail and river tonnage, aggregated in 1906 only nine-tenths of 1 per cent of the total traffic.

## V.

### MISSOURI RIVER COMMERCE.

Missouri River commerce reached its height previous to the civil war and much of the equipment was destroyed during that struggle. The discovery of gold in Montana in 1862 furnished a slight incentive to waterway travel, as the Missouri was the only possible means of reaching the gold fields. Such passenger traffic as was developed after the war consisted of gold seekers, pioneers, Indians, and United States troops. Some attempt was made to handle through freight traffic between St. Louis and the head of navigation at Fort Benton, 2,300 miles away. In 1867, for example, 71 steamers left St. Louis for Fort Benton and the upper Missouri, averaging 260 tons each and carrying a total of 16,655 tons. The average time consumed in the journey was about two weeks.[1]

The river seems very early to have been divided for navigation purposes into three stretches—that from its mouth to Kansas City or Omaha; that from Sioux City, Iowa, to Bismarck, N. Dak.; and that from Bismarck to Fort Benton, Mont., or in low water, to the mouth of the Yellowstone. The boats which could reach these upper waters were of small capacity. The traffic never developed significant proportions and the details are hardly worth reproduction. It

[1] Ex. Doc., 40th Cong., 3d sess., vol. 2.

is sufficient to say that the downstream traffic in the most prosperous times, and in the best stages of water, consisted principally of ores and bullion, wool, hides, and skins, and the upstream traffic of supplies for the pioneers and military garrisons. In 1881 there were five lines of steamboats which made their headquarters at Bismarck, and 21 boats plied between that town and points on the Missouri, making in the season 150 to 175 trips. These boats carried into Montana 13,780 tons of private freight and 3,600 tons of government freight besides 1,300 passengers, 2,400 Indians, 1,800 head of horses and cattle, and 600 head of sheep. The exports from the upper river so far as ascertained included 23,000 buffalo hides, 180 tons of wool, 253,750 tons of hides, and furs and wolf skins.[1]

But the invasion of this territory by the railways practically put an end to what little commerce the river interests had developed. Railway rivalry dates from the close of the war, and soon after 1870, the Missouri River along its entire length was subject to the severest railway competition which any waterway in the country experienced. In 1906, above Sioux City, Iowa, only 10 boats were engaged in freight and passenger traffic, the freight carried including 9,540 tons of grain, 8,250 tons of live stock, 5,567 tons of lumber and wood, 11,780 tons of sand and building material, and 8,850 tons of general merchandise. A line of boats handling grain and general merchandise also operated from Bismarck to points on the Yellowstone River. This part of the river is mainly used to-day by gasoline barges carrying goods to and from railway crossings. From Sioux City to the mouth of the Missouri the principal traffic was sand and stone, with a small movement of lumber, grain, and general merchandise. In 1906 the total tonnage handled on the lower Missouri was only 573,348 tons.

The small part played by the Missouri River in internal-waterway commerce is due not alone to the intense and successful railway competition which has prevailed throughout its drainage area. It is due in part to the tortuous, treacherous, and frequently obstructed channel, upon which the expenditures of the Government, amounting up to June 30, 1907, to $11,191,000, have had as yet little, if any, effect in the improvement of navigation. Capital, even if not fearful of railway competition, has little desire to engage with an unruly stream in a struggle of which the issue is so doubtful.

## VI.

### LOWER MISSISSIPPI COMMERCE.

One of the most interesting attempts to resuscitate the commerce of the lower Mississippi after the war is found in the organization of companies for the operation of barge lines between St. Louis and New Orleans. The invasion of river territory by the railways had, for reasons already noted, led to the abandonment of the old passenger packet steamboat in favor of towboats or propelling steamboats with tows of barges or flats which held the freight. This has already been shown in the description of the Ohio River coal trade. This method appeared again in the St. Louis barge lines, but with

[1] Ex. Doc., 48th Cong., 1st sess., vol. 4.

this difference, that the barges were much larger and more expensively constructed, and that the propellers were built with a greater view to speed than was the case with the Ohio boats. It was intended that these lines should handle general merchandise as well as grain, and should deliver their products speedily and on schedule time at New Orleans.

The boats carried fuel for a round trip and no passengers except the crews. They made stops only long enough to pick up additional barges at points along the river, and in this way could avoid steamboat delays and make a high average speed.

The barges had a capacity of from 50,000 to 60,000 bushels of grain each, and could be loaded quickly from elevator spouts. A tow boat often left St. Louis with from 4 to 6 barges attached. At New Orleans stationary and floating elevators received the grain. The character of traffic other than grain handled by the barges is best illustrated by the description of a shipment from St. Louis in 1880 quoted by the St. Louis Republican. The contents of the barges were as follows:

4,371 barrels of flour.
1,296 barrels of meal.
1,090 barrels of grits.
5,258 sacks of corn.
802 sacks of oats.
650 sacks of bran.
1,296 packages of lard.
204 packages of meat.
150 bales of hay.
24,992 bushels of bulk corn.

This total was estimated as equivalent to 155 carloads of freight.

In 1875 there were only 4 tugboats and 30 barges employed between St. Louis and New Orleans, but in 1887 four barge lines were operating 16 tugboats and 120 barges. These barge lines were later consolidated into one corporation known as the "St. Louis and Mississippi Valley Transportation Company."

The most important traffic of the barge lines was that in bulk grain, and the commercial history of this commodity is worth a moment's attention. In the early part of the nineteenth century New Orleans had received large quantities of cereals by river for export to foreign ports and to Atlantic seaboard cities. This traffic fell off after the invasion of the primary grain markets by the railways, with the result that in 1873 New Orleans exported less than 2½ per cent of the corn and less than one-half of 1 per cent of the wheat. Grain, particularly corn, still moved south for local consumption, but in increasing proportion by rail. The Select Committee on Transportation Routes to the Seaboard stated that the export of wheat from New Orleans in 1873 was 243,027 bushels out of a total export of 50,733,672 bushels, of which New York handled 21,221,254 bushels. Of corn 946,457 bushels were exported in 1873 from New Orleans out of a total from the United States of 38,541,930 bushels.

In the handling of grain out of St. Louis there appears very early to have been genuine competition between rail and water routes. The first shipment of grain from St. Louis east by rail took place in 1865, and from that date the railways extending to the Atlantic seaboard frequently engaged in rate wars, at one time transporting

grain from St. Louis to the seaboard at as low a rate as 9 cents per bushel. In 1878 a pool was formed embracing all the roads connecting the Atlantic seaboard with St. Louis and other competing western points. The railways, being bound to maintain their rates, could no longer meet the water rates. This, coming coincidently with the completion of the jetties at the mouth of the river, gave such a stimulus to river commerce that almost the entire grain exports from St. Louis went to new Orleans. But this sudden burst of prosperity was short lived. The railways were at war again in 1881, and the river boats were unable to carry grain at war rates. For a time thereafter the grain traffic by river fluctuated with the condition of harvests, and with the signing or breaking of treaties of peace between the railways, but after 1896 it entered upon a decline, and in 1903 it ceased altogether. To the destruction of barge-line traffic not alone railway competition, but also a rapid depreciation of equipment and high marine insurance rates contributed. The following table, compiled by the Bureau of Corporations,[1] shows the traffic in grain from 1870 to 1903.

*Shipments of bulk grain from St. Louis to New Orleans via Mississippi River boats, 1870–1903*

[Compiled from St. Louis Merchants' Exchange reports.]

| Year. | Wheat. | Corn. | Rye. | Oats. | Total. |
|---|---|---|---|---|---|
| | *Bushels.* | *Bushels.* | *Bushels.* | *Bushels.* | *Bushels.* |
| 1870 | 66,000 | | | | 66,000 |
| 1871 | | 309,077 | | 3,000 | 312,077 |
| 1872 | | 1,711,039 | | | 1,711,039 |
| 1873 | | 1,373,969 | | | 1,373,969 |
| 1874 | 365,252 | 1,047,794 | | 10,000 | 1,423,046 |
| 1875 | 135,961 | 172,617 | | | 308,578 |
| 1876 | 37,142 | 1,737,237 | | | 1,774,379 |
| 1877 | 351,453 | 3,578,057 | 171,843 | | 4,101,353 |
| 1878 | 1,876,639 | 2,857,056 | 609,041 | 108,867 | 5,451,603 |
| 1879 | 2,390,897 | 3,585,589 | 157,424 | 30,928 | 6,164,838 |
| 1880 | 5,913,272 | 9,804,392 | 45,000 | | 15,762,664 |
| 1881 | 4,197,981 | 8,640,720 | 22,423 | 132,823 | 12,993,947 |
| 1882 | 5,637,391 | 2,529,712 | 15,994 | 150,320 | 8,333,417 |
| 1883 | 1,435,043 | 9,029,509 | 205,430 | 389,826 | 11,059,808 |
| 1884 | 1,318,688 | 4,496,785 | 344,864 | 487,221 | 6,647,558 |
| 1885 | 50,000 | 8,180,039 | 36,093 | 401,787 | 8,667,919 |
| 1886 | 743,439 | 7,501,730 | | 598,755 | 8,843,924 |
| 1887 | 3,973,737 | 7,365,340 | | 217,722 | 11,556,799 |
| 1888 | 1,247,952 | 5,844,042 | | 160,584 | 7,252,578 |
| 1889 | 1,651,950 | 12,398,955 | 17,432 | 89,707 | 14,158,044 |
| 1890 | 1,409,440 | 8,717,849 | | 89,960 | 10,217,249 |
| 1891 | 6,940,215 | 1,482,731 | 45,600 | | 8,468,546 |
| 1892 | 5,149,708 | 3,228,645 | | 36,587 | 8,414,940 |
| 1893 | 3,710,360 | 3,293,808 | | 75,430 | 7,079,598 |
| 1894 | 1,042,193 | 1,263,310 | | 40,000 | 2,345,503 |
| 1895 | 438,614 | 1,251,803 | | | 1,690,417 |
| 1896 | 1,732,563 | 8,358,087 | | 436,558 | 10,527,208 |
| 1897 | 1,191,032 | 3,827,963 | 190,968 | 265,379 | 5,475,342 |
| 1898 | 2,747,994 | 3,006,488 | 212,720 | 633,505 | 6,600,707 |
| 1899 | 234,720 | 1,748,517 | | 249,998 | 2,233,235 |
| 1900 | 169,241 | 2,871,870 | | 273,049 | 3,314,160 |
| 1901 | 1,828,244 | 535,705 | | | 2,363,949 |
| 1902 | 2,308,714 | 226,400 | 28,212 | 28,409 | 2,591,735 |
| 1903 | 1,724,220 | 1,025,221 | | | 2,749,441 |

For the seventeen years from 1887 until 1903 the average published rates on grain from St. Louis to Liverpool by river to New Orleans were from 5 to 9 cents per bushel lower than those via rail to New York. If these published rates were the actual rates charged, it is evident that other considerations were sufficient to offset a consider-

[1] Transportation by Water in the United States, Part II.

able advantage in the transportation charge. The following table gives the comparative rates for this period:

*Average published rates of freight St. Louis to Liverpool on wheat, in cents, per bushel, 1887–1903.*[1]

| Year. | Via river and New Orleans. | Via rail and New York. | Year. | Via river and New Orleans. | Via rail and New York. |
|---|---|---|---|---|---|
| 1887 | 15 | 24⅛ | 1896 | 13.50 | 19.67½ |
| 1888 | 15½ | 22.95 | 1897 | 12.89 | 20.33 |
| 1889 | 17½ | 24.97 | 1898 | 14.24 | 20.32 |
| 1890 | 14½ | 21.48 | 1899 | 12.33 | 17.88 |
| 1891 | 15⅜ | 23.55 | 1900 | 14.64 | 18.41 |
| 1892 | 14 | 21 | 1901 | 9.48 | 14.03 |
| 1893 | 14.71 | 21.72 | 1902 | 8.53 | 15.33 |
| 1894 | 11.69 | 18.71 | 1903 | 10.00 | 16.02 |
| 1895 | 12⅛ | 18.33 | | | |

[1] Report St. Louis Merchants' Exchange, 1908.

Lack of railway facilities in the South before the war and the execrable condition of the roads led the planters to locate their cotton lands along the river banks, and transportation of cotton was almost wholly by water. Alabama planters sent their cotton by way of the Tennessee River to New Orleans, and such points as Memphis, Vicksburg, Natchez, and Shreveport became important collecting and shipping ports. In the decade 1850–1860 cotton was by far the most important product received by river at New Orleans.

With the development of railways in the South after 1865, the establishment of cotton-manufacturing plants at various points in the South, the extension of cotton culture westward beyond the Mississippi into territory not served by waterways, and the change in the methods of purchasing, compressing, and shipping cotton, the waterways became of decreasing importance. The immense cotton territory extending up the Mississippi and along the Red, Ouachita, Arkansas, and White rivers, which had sent its cotton to New Orleans wholly by water, began to ship its product by rail. By 1880 shipments of cotton from the Arkansas and the White rivers had practically ceased. The Red and the Ouachita still clung for a time to traffic which was too remote from a railway to be economically handled in that manner. But in 1881 a branch of the Texas and Pacific was completed which paralleled the Mississippi to Baton Rouge, and followed in general the direction of the Red River as far as Shreveport. This soon reduced the commerce of the Red River to insignificance.

In the early days Vicksburg was one of the most important commercial dependencies of New Orleans, shipping immense quantities of cotton and receiving supplies for distribution inland. But the Yazoo country was lost to the river when the Yazoo and Mississippi Railroad, running through the Mississippi delta region, was opened in 1884. In 1899 this railway carried 483,000 bales of cotton or 40 per cent more than all the rivers combined. The Natchez, Jackson and Columbus Railroad was completed in 1882. Natchez, formerly the most important river town between New Orleans and Louisville, was soon thereafter without any regular packet line from New Orleans. By 1887 three-fourths of the cotton of Natchez and

Vicksburg was being handled by rail. Northeastern Mississippi, northern Georgia, western Tennessee and Kentucky in this period began sending their cotton by rail to Savannah, Charleston, and Norfolk. Memphis, although still receiving a considerable quantity of cotton by river, 25,392 tons in 1906, sends out most of it by railway.

New Orleans has been compensated for her river losses by rail receipts from Texas plantations, so that the total cotton receipts at New Orleans has steadily increased. The following table shows the receipts of cotton at New Orleans for a series of years, and the percentage received by river:

*Receipts of cotton at New Orleans.*[1]

| Year. | Receipts by rail. | Receipts by river. | Percentage by river. |
|---|---|---|---|
| | *Bales.* | *Bales.* | |
| 1873 | 438,495 | 968,877 | 68.8 |
| 1875 | 406,076 | 750,080 | 64.8 |
| 1880 | 627,577 | 1,087,522 | 63.5 |
| 1885 | 1,018,261 | 680,376 | 40.0 |
| 1890 | 1,722,473 | 425,828 | 19.8 |
| 1899 | 1,935,177 | 343,450 | 15.0 |
| 1904 | 1,833,755 | 192,842 | 9.5 |
| 1907 | 2,082,053 | 231,381 | 10.0 |

[1] Reports New Orleans Cotton Exchange.

The decline in grain and cotton traffic on the lower Mississippi is typical of the movement on this section of the river. By 1887 there was not, with the exception of Bayou Sara, a town on the lower Mississippi of over 1,000 population which was without railway connection with New Orleans, St. Louis, or Memphis. To the boating interests was left undisturbed only the local commerce between the river villages. Evansville, Paducah, and Wheeling had no longer direct lines of steamers to New Orleans. The Cincinnati trade had been reduced to one-quarter of its former size, and one line of through steamers was sufficient to care for the Cincinnati and Louisville trade with New Orleans. The latter city had almost entirely lost its earlier trade in "western products," as the following table shows:

*Western produce exported from New Orleans, for the years 1856 and 1886.*[1]

| Article. | | Year ending June 30— | |
|---|---|---|---|
| | | 1856. | 1886. |
| Wheat flour | barrels | 251,501 | 24,832 |
| Beef | pounds | 1,177,700 | 126,546 |
| Bacon and hams | do | 3,846,150 | 149,481 |
| Pork | do | 4,675,900 | 801,588 |
| Lard | do | 20,066,901 | 347,196 |
| Spirits, distilled | gallons | 25,833 | 3,540 |

[1] Report on Internal Commerce of the United States, 1886.

Since 1887 the situation has not improved and to-day the river from St. Louis south, aside from the transportation of cotton on its lower stretches, and the receipt and conveyance of coal from the Ohio, is a negligible transportation factor.

There are no longer any through passenger or packet boats from St. Louis to New Orleans. All through freights (except on barges) must usually be transferred from packet to packet at Memphis and Vicksburg. Occasionally a few passenger boats make the through trip upstream or down for the benefit of excursionists, but only a few times a year.[1] Between St. Louis and Cairo there is nothing but local traffic between river towns. The total tonnage handled in 1906 amounted to 458,000 tons, of which the largest items were coal 171,000 tons and logs 120,000 tons. Cairo was formerly an important river shipping point for grain, but the railways destroyed the water traffic by low rates, and by granting certain transit privileges and establishing switch connections. It is a typical instance of the struggle of efficiency against inefficiency, which will be referred to again in the conclusion to this discussion.

Between Cairo and Memphis the through business is controlled by railways on both sides of the river and, except for coal southward and lumber northward, the traffic is insignificant and local. One packet line only operates between Memphis and St. Louis and Cincinnati. Between Memphis and Vicksburg there is a considerable traffic in logs and lumber brought down from the tributaries. Southward the logs are propelled in rafts, but northward they are handled, like lumber, in barges. The season is a long one, usually about nine months, and the radius of movement is 250 to 300 miles from Memphis. In 1906 about three-quarters of a million tons were handled.

Cotton begins to appear in the river statistics from Memphis southward. Iron and steel products to some extent come down the river to Memphis from the Pittsburg district. From Memphis southward are shipped general merchandise and plantation supplies; return shipments, which are considerable, consist of cotton and cotton seed. Commerce on the White River in 1907 amounted to 128,000 tons, most of which was logs, ties, and lumber. On the Arkansas in 1907 the total tonnage was 105,000 tons, largely logs and lumber.

Between Vicksburg and New Orleans the local traffic is greater, and miscellaneous merchandise plays a larger part. Only a few local lines remain in operation from Vicksburg south, as this stretch of the river is under almost complete railway dominance. Yazoo River commerce amounted in 1907 to 228,000 tons, the largest items being lumber and logs. The Red River still ships some cotton, lumber, and plantation supplies, the extent of the traffic varying with the condition of navigation, and cotton and lumber still come from the Ouachita. Of the total commerce on the Mississippi proper between Vicksburg and New Orleans, amounting in 1906 to 2,554,000 tons, 832,000 tons, or 33 per cent, consisted of coal from the Ohio, and 859,000 tons, or 34 per cent, of gravel, sand, and stone.

The commerce of the river port of New Orleans has been discussed already in connection with the coal, grain, and cotton trade. Aside from these products, and the lumber and logs received from the Mississippi tributaries, there is some traffic in rough rice, in petroleum, and in miscellaneous merchandise. The total river commerce of New Orleans is estimated by the Bureau of Corporations to be over 1,800,000 tons. If this figure be compared with a total in 1880 of

[1] H. Doc. No. 50, 61st Cong., 1st sess.

2,959,250 tons, not including rafts, it will be seen that there has been a heavy falling off in river commerce at this port.

Neither has this port been able, even with the aid which railways have afforded in later decades, to maintain its position as an exporting and importing point. In 1860, 27 per cent of the total exports from the United States went by way of New Orleans and 6.3 per cent of the imports were received through this port. In 1886 the percentage of exports was 12 per cent and of imports 1.1 per cent; in 1907 the percentage of exports was 9.07 per cent and of imports 3.21 per cent. However, other causes, beyond the scope of the present discussion, have affected the position of New Orleans as a commercial port.

The present condition of traffic on the lower Mississippi may be clearly shown by the reproduction of a table presented in a recent report of a board of United States engineers.[1]

[1] H. Doc. No. 50, 61st Cong., 1st sess.

*Tonnage and traffic of the Mississippi River, St. Louis, Mo., to New Orleans, La., year 1907.*[1]

| Lower Mississippi, St. Louis to New Orleans. | Total number of passengers received and discharged. | Receipts and deliveries at principal ports and way stations. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Grain and its products. | Cotton. | Cotton seed. | Live stock. | Coal and coke. | Lumber. | Logs. | Iron, steel, and metals. | Groceries and provisions. | Oil. | Stone, gravel, and sand. | Unclassified and miscellaneous. |
| DOWNSTREAM. | | | | | | | | | | | | | |
| | | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| Received at St. Louis | 21,251 | 2,782 | | | 319 | 10 | 226 | 375 | 709 | 3,485 | 83 | | 34,863 |
| Received between St. Louis and Cairo | 2,981 | 10,392 | | | 374 | | 78 | 19,800 | | | | 1,000 | 3,238 |
| Discharged between St. Louis and Cairo | 12,387 | 1,576 | | | 540 | | 214 | 6,000 | 444 | 2,730 | 78 | 1,000 | 17,250 |
| Discharged at Cairo | 3,693 | 11,598 | | | 153 | 10 | 90 | 14,175 | 265 | 755 | 5 | | 4,301 |
| Received at Cairo | 4,324 | | | | | 1,067,154 | | | 27,938 | | | 14,200 | 11,889 |
| Received between Cairo and Memphis | 8,756 | 1,000 | 10,337 | 8,201 | | 4,000 | 8,292 | 170,980 | | | | 1,000 | 5,702 |
| Discharged between Cairo and Memphis | 3,576 | 1,000 | | 1,602 | | 28,950 | | 37,000 | 676 | | | 1,000 | 16,730 |
| Discharged at Memphis | 17,686 | | 10,337 | 6,599 | | 205,825 | 8,292 | 133,980 | 9,290 | | | 1,600 | 15,347 |
| Received at Memphis | 36,408 | 13,094 | | 40 | 2,196 | 24,070 | 1,952 | | 2,774 | 12,273 | 364 | 10,000 | 21,510 |
| Received between Memphis and Vicksburg | 28,228 | 3,594 | 11,811 | 8,534 | 2,173 | 10,520 | 573 | 218,000 | 358 | 2,940 | 168 | 878,294 | 4,123 |
| Discharged between Memphis and Vicksburg | 55,814 | 16,688 | 5,171 | 1,774 | 4,301 | 35,129 | 2,525 | 153,000 | 3,374 | 14,909 | 525 | 791,154 | 25,124 |
| Discharged at Vicksburg | 8,647 | | 1,795 | 4,050 | 18 | 24,340 | | 65,000 | 4,754 | 304 | 7 | 100,000 | 279 |
| Received at Vicksburg | 7,987 | 410 | 483 | | 520 | | 732 | | | 3,124 | 19 | | 9,157 |
| Received between Vicksburg and New Orleans | 11,731 | 19,254 | 29,562 | 26,458 | 762 | 52,200 | 21,712 | 167,007 | 450 | 43,510 | 101,497 | 138,351 | 96,952 |
| Discharged between Vicksburg and New Orleans | 16,251 | 770 | 1,467 | 2,170 | 1,130 | 116,200 | 1,119 | 87,007 | 500 | 15,260 | 70,028 | 3,200 | 21,824 |
| Discharged at New Orleans | 3,642 | 18,894 | 33,423 | 27,038 | 202 | 747,500 | 21,325 | 80,000 | 12,926 | 31,374 | 31,488 | 144,951 | 86,579 |
| UPSTREAM. | | | | | | | | | | | | | |
| Received at New Orleans | 5,707 | 6,989 | | | 402 | 300 | 8,432 | | 2,125 | 27,191 | 86,749 | | 15,802 |
| Received between New Orleans and Vicksburg | 16,645 | 79 | 3,370 | 43,034 | 600 | 200 | 13,302 | 19,800 | 200 | 500 | 29,497 | | 14,894 |
| Discharged between New Orleans and Vicksburg | 13,460 | 7,068 | 2,489 | 11,206 | 1,002 | 500 | 724 | 5,000 | 2,325 | 22,052 | 112,636 | | 30,473 |
| Discharged at Vicksburg | 8,192 | | 881 | 31,828 | | | | | | | | | 100 |
| Received at Vicksburg | 8,268 | 3,946 | 54 | | 102 | 50 | 1,840 | | 323 | 4,372 | 42 | | 3,363 |
| Received between Vicksburg and Memphis | 48,061 | 1,303 | 25,913 | 15,632 | 3,125 | 15 | 121,012 | 145,895 | 367 | 2,422 | 47 | | 9,174 |
| Discharged between Vicksburg and Memphis | 32,963 | 5,209 | 9,409 | 7,288 | 1,955 | 65 | 337 | 20,200 | 572 | 9,715 | 89 | | 7,928 |
| Discharged at Memphis | 23,366 | 40 | 16,558 | 8,344 | 1,272 | | 15,933 | 79,795 | 118 | 201 | 3,610 | | 4,732 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Received at Memphis | 22,626 | | 534 | | | | | 1,800 | | | | | 13,013 |
| Received between Memphis and Cairo | 3,450 | 3,193 | 1,037 | 1,075 | | | 35,589 | 218,889 | | | | | 36,342 |
| Discharged between Memphis and Cairo | 13,643 | | 19 | 98 | | | | 11,000 | | | | | 5,748 |
| Discharged at Cairo | 4,138 | 3,193 | 572 | 977 | | | 161,718 | 231,389 | | 2,517 | | | 38,437 |
| Received at Cairo | 3,943 | 75 | 542 | 260 | 268 | 166,350 | 23,156 | | | 195 | | | 2,533 |
| Received between Cairo and St. Louis | 8,138 | 8,161 | | | 10,114 | | 257 | | 30 | 700 | 4 | | 9,149 |
| Discharged between Cairo and St. Louis | 1,485 | 442 | | | 28 | | | | | 25 | | | 975 |
| Discharged at St. Louis | 18,891 | 7,794 | 1,522 | 260 | 10,354 | 166,350 | 24,876 | 39,000 | 30 | 870 | 4 | | 15,877 |

[1] H. Doc. No. 50, 61st Cong., 1st sess.

## SUMMARY.

It is difficult to summarize statistically the present traffic condition of the Mississippi River system. The reports of the corps of United States Engineers cover specific sections of the river, and are published as made, with no attempt to unify them and eliminate duplications. The Census Report on Transportation by Water in 1906 excluded all logs and lumber in rafts, and confined its statistics to the traffic transported by some form of vessel. Inasmuch as rafting has always been one of the chief sources of reliance for interior river commerce, this leaves the total figures incomplete at a vital point. The total receipts and shipments on the entire system for vessels of over 5 tons, including harbor traffic and car ferries, amounted in 1906 to 31,626,981 net tons. To this should be added, according to the report of Bureau of Corporations, at least 6,000,000 tons of logs and rafts. Of the total freight movement, exclusive of harbor traffic and car ferries, amounting to 19,531,093 tons, more than 56 per cent was coal, and 20 per cent stone and sand. This was an increase in coal traffic since 1889 of 29.4 per cent, and in stone and sand of 1,147 per cent. Lumber and logs in rafts not being included, it is impossible to determine exactly their movement during these fifteen years, but the decline has probably been fully 25 per cent. The movement of grain, cotton, and iron ore has fallen to insignificant amounts.

A characteristic feature of river transportation, which has been growing steadily more pronounced since 1865, is the predominance of the unrigged craft over the packet steamboat. In 1906, out of a total of 9,622 vessels on the river system, 8,187, or 85 per cent, were unrigged, and of the steam vessels only 390 were employed for the carrying of freight and passengers in regular river service. The remainder were tugs and towing vessels, ferryboats and yachts. By these unrigged craft most of the traffic was transported, the largest part of the commerce being in Ohio River coal. Out of a total of 19,531,093 tons carried, 13,980,368 tons, or 71 per cent, were transported on the Ohio in barges and flats. Aside from bulk traffic in barges, flats, and rafts, the business on the river is almost wholly local and for short distances.

This decline has been the subject of much comment, particularly by those who have observed the extended use to which waterways have been put in many of the European countries. Yet the causes are not far to seek. It should be remarked, however, that they are so interwoven one with the other that it will be somewhat difficult to discuss them separately without apparent exaggeration of the importance of the particular cause as it is considered.

The first cause which suggests itself is that of the influence of competitive agencies, beginning with the eastward movement by lake and canal early in the thirties, and followed by the rail movement in the next two decades. This latter agency was undoubtedly more efficient from the very beginning, because of its greater power to adapt itself to varied traffic requirements. It is flexible in matters of speed, extensibility, terminal adaptability, and the like, and it is, moreover, much more reliable. Consequently, it drew away at once all passenger travel, except excursion business and local or ferry

traffic, and all mail, express, and fast-freight business, which deprived the steamboats of their most lucrative sources of earnings, being greatly aided in this endeavor by the interruption to water transportation during the war. But not only was the railway naturally more efficient, but it grew more efficient, relatively, as the years went on, for the steamboat business stood still or declined after 1860, except in its handling of a few products by barge.

Whether it is true or not, as frequently charged, that railways have secured control of steamboat lines, have purposely kept them inefficient, and have operated them to keep efficient service off the rivers, it is undoubtedly true that they have, as earlier noted, reduced rates at water competitive points and recouped themselves elsewhere. In this practice, supported as they are by judicial decree, they have a monopolized advantage from which competing steamboat lines are excluded.

The question whether the rivers any longer exert an influence upon rail rates has been frequently debated, emphatic assertions by the railways that such influence is still potent being met by equally emphatic statements that the river in its present condition is powerless to affect the rail rate. In the preliminary report of the Inland Waterways Commission are included elaborate comparisons of rail and water rates to various points for different classes and kinds of commodities. It would appear from a careful study of the tables bearing upon the Mississippi River situation that the waterway, inefficient as it is, exerts an influence to-day upon the rail rate varying in degree according to circumstances. This is made clear by a comparison of rates charged by railways paralleling the Mississippi north of St. Louis, where water traffic still prevails, with rates charged for similar distances by railways paralleling the Missouri, which is no longer a commercial factor. Rates on this stretch of the Mississippi are lower for the same commodity and distance. Yet when the cost of marine insurance is added to the river rate, and also the drayage charges which so frequently accompany the consignment and receipt of river traffic, it is a question whether railways could not, if they saw fit, absorb most of the water traffic, provided their equipment was adequate.

The table given below includes typical rates drawn from an exhibit presented in a recent special report of a board of United States engineers. It shows in parallel columns the rail and water rates on sections of the lower Mississippi. It will be observed that in some cases the rail rates are lower than the water rates, in some cases materially higher, and in some cases the rates are identical. Notwithstanding these variations, however, most of the traffic seeks the railway. One further fact should be noted. The distance between terminal points is in every case materially shorter by rail. This is an advantage which the railway almost invariably enjoys.

*Freight rates per ton by rail and water, December, 1908.*[1]

| Terminal points. | Mileage distance. | | Sand and gravel. | | Manufactured iron. | | Grains and seeds. | | Cotton. | | Sugar and molasses. | | Iron ore. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Water. | Rail. | Water. | Rail. | Water. | Rail. | Water. | Rail. | Water. | Rail. | Water. | Rail. | Water. | Rail. |
| From St. Louis to— | | | | | | | | | | | | | | |
| St. Paul | 729 | 576 | $2.00 | $1.70 | $2.80 | $4.20 | $2.80 | $3.00 | $8.00 | $5.20 | $3.40 | $3.20 | $2.00 | $3.00 |
| Cairo | 182 | 150 | ..... | .75 | 2.00 | 2.10 | 3.00 | ..... | ..... | ..... | 2.00 | 2.72 | ..... | 1.68 |
| Memphis | 420 | 311 | ..... | 1.60 | 3.00 | 2.60 | 5.00 | 2.40 | 3.00 | 2.20 | 2.50 | 6.00 | ..... | 3.00 |
| From New Orleans to— | | | | | | | | | | | | | | |
| Vicksburg | 366 | 227 | 2.50 | 1.60 | ..... | 2.40 | 2.40 | 2.40 | 4.00 | ..... | 2.00 | 2.00 | ..... | 3.40 |
| Natchez | 284 | 214 | ..... | 1.60 | ..... | 2.40 | 2.40 | 2.40 | 4.00 | ..... | 2.00 | 2.00 | ..... | 3.40 |
| Baton Rouge | 132 | 89 | .30 | 1.40 | ..... | 2.40 | 2.00 | 1.60 | 3.00 | 3.00 | 2.00 | 1.50 | ..... | 1.40 |

[1] H. Doc. 50, 61st Cong., 1st sess.

The lack of development of river equipment, already referred to, has been based in large part upon legitimate grounds—an unwillingness to invest capital in an industry so highly speculative. The risks are not alone those of railway origin, but they arise in part from the natural difficulties of navigation. Obstructions due to snags and bars on all the rivers except the Missouri have to a considerable extent been removed, although they are constantly liable to reappear. The barrier at the mouth of the Mississippi, which until 1878 gave the railways a decided advantage, is now gone. But there still remain many obstacles. Ice stops navigation for many months of each year in the upper river. The swiftness of the current demands a costly adjustment of business methods to meet the requirements of upstream traffic—a difficulty absent in the Lakes. The shifting and irregular current and the uncertainty of the water supply menace navigation. To such an extent is this true on the upper Mississippi that the one line now operating between St. Louis and St. Paul declines to make season contracts, and accepts shipments for single trips only. Then there are the variations in depth of water, most strikingly shown on the upper Ohio with the January and February floods, when the river sometimes rises at Cincinnati to 70 feet above low-water mark. This variation in water depth is not alone dangerous to navigation, but it prevents the application of capital to the greatest economic advantage. On the Lakes, with an assured depth of water, the largest vessels can be employed and loaded to their capacity. It is not profitable to build vessels on the rivers which can run only in the best stages, and which must lie idle during the rest of the year. But light-draft vessels are not economical in good stages of water. Moreover, these sharp and sudden variations in the stage of water have made fixed wharves impossible and have compelled the use of the less efficient floating dock. In low stages the cost of loading and unloading is sensibly increased in many places by reason of the steep and high river banks.

But navigation is hindered not alone by variations in stage of water due to floods and droughts, but also by the normal difference in depth of the different sections of the river system. The lack of development in the past of any through traffic from the upper Mississippi to New Orleans, and the persistence of the costly practice of transfer at St.

Louis, have been due to this difference in depth of the lower and upper river, and to the consequent difference in draft of vessel employed. It was to meet this difficulty that the barge system was introduced, whose units, similar to railway cars, could be dropped or attached at will, and handled on different stretches of river without the necessity of transfer of load.

Although it must be admitted that from a navigation standpoint the condition of the Mississippi is much superior to what it was in the days of its commercial prosperity, yet much remains to be done and much which is once done has to be frequently repeated. The destruction of banks due to shifting channels, and the fact that the Missouri uses the lower Mississippi as a dumping ground, make continuous dredging necessary, and any lessening of vigilence in this direction through failure of congressional appropriations is promptly punished by a serious impairment of the navigability of the stream. Yet however serious navigation difficulties may appear to us, they can not, except to a small degree, explain the decline of river commerce. For in spite of all obstructions, we possess free waterways which are in many respect superior to those of Europe; yet we have but a fraction of their tonnage. A dead low-water channel of 4½ feet prevails throughout the year from St. Paul to the mouth of the Missouri. Four feet draft prevails on the Missouri at low water as far as Kansas City. From St. Louis to Cairo there are only a few days in the year when a boat drawing 8 feet can not operate freely. Below Cairo for 840 miles there is a 9-foot depth during low water, and for the last 270 miles boats of 25 to 30 feet draft can operate. On the Ohio from Cairo to Pittsburgh, there is a 9-foot depth during medium stages of water, which is being improved to a 9-foot depth at low water. In comparison with these figures it should be noted that much of the canal and upriver boat traffic of Europe is performed on 1 meter (3.28 feet) draft; most of it is done on 2 meters (6.56 feet) draft and 10 feet draft is exceptional.[1] Hence it is lack of uniformity in different sections of the river, and a resulting inability to use equipment to the best advantage, rather than the shallowness of the streams which must be accounted the important navigation obstacle.

In the third place, whether, as a result of the two causes just mentioned, railway competition and navigation obstacles, or whether, because of a lack of initiative on the part of river interests after the war, the steamboat business has been wholly lacking in the administrative organization necessary to cope with so superbly organized an industry as the railway. Capital has kept out of it. The river steamboat, except that it has changed from a passenger to a freight carrier, is the same craft as always. As late as 1906, out of a total of 1,435 steam vessels on the Mississippi River system, 1,358, or 95 per cent, were of wood. The old inefficient "roustabout" labor is still employed, and no attempt whatever has been made to introduce mechanical appliances for loading and unloading. There are very few satisfactory wharves and docks, many of the landings being made on the river bank, and the goods dumped on shore without cover. As the rivers are at the lowest levels, goods must be hauled uphill to reach a place of sale. Good natural landings are few, and artificial

[1] H. Doc. 50, p. 329, 61st Cong., 1st sess.

ones are too expensive to be within the reach of small communities. Thus the terminal expenses as compared with the more flexible railway are very heavy.

Adequate terminal facilities are in very few instances owned or controlled by water lines.

St. Louis, Mo., has little wharfage, either public or private, except the graded river bank; East St. Louis has almost no public landings and few private ones; Cairo, Ill., has several piers and slips and some few floating boat landings and warehouses, but all under private monopoly. Memphis and Vicksburg have limited public landings, consisting merely of graded banks and occasional floating warehouses. The other cities are less well provided. Such transfer facilities as exist at the Lake Superior and Lake Erie grain, ore, and coal harbors are unknown on the Mississippi. The injury to freights and cost of transfer by reason of necessary rehandling at the water's edge, and subsequent cartage up the bank and across the city to the consignee, are usually sufficient to outbalance a decided higher freight rate by rail.[1]

In many cases all satisfactory terminal property has been acquired by the railways. For example, portions of the river front at Pittsburgh, New Orleans, St. Louis, and Vicksburg are owned by railway corporations. The primary purpose of the railways is not to check the development of water transportation, but to secure desirable land for switch tracks and yards, yet its effect upon the development of steamboat traffic is disastrous.

Furthermore, nearly half of the steam vessels operated on the Mississippi, representing, however, only about one-quarter of the tonnage, are owned by individuals, and are run independently with very little thought of securing united action toward better organization of river traffic. This makes it impossible for shippers to arrange for through handling of goods. Repeated rehandlings by irresponsible steamboat captains cause damage to the goods, and make location of responsibility for the damage difficult and the settlement slow and costly. Practically the only traffic which is well organized is that of coal on the Ohio, and this is largely under the control of a single corporation. Of the total tonnage in 1906 of unrigged vessels, 96.6 per cent was owned by corporations.

Finally there was and still is a fundamental cause of decline of river commerce to be found in the relation of traffic movement to traffic agencies. So long as wheat and corn were produced near the waterways and could be disposed of at markets located on the rivers, traffic by river continued; but so soon as either of these conditions was no longer present, the railway began to take the business. If grain was shipped from a river port and required transfer to rail for delivery at a primary market, like Chicago, the expense of transfer and the lack of all facilities for satisfactory handling turned the traffic at its source to the railways. When grain began to be produced away from the waterways, it had to be loaded at first into railway cars, and once in the cars it remained there until it reached its market. The movement of the wheat area northwestward to a region west of Lake Superior and the advance of the corn area westward enhanced this tendency, and the railways encouraged it both by the provision of suitable facilities for storage and handling and by the adjustment of their rates. The effect upon the Mississippi River is strikingly shown by the fact that although in the fifties there were many towns with prospects of rapid and successful development, yet at the census of

[1] H. Doc. 50, 61st Cong., 1st sess.

1900 there was not a river town from St. Paul to St. Louis with 40,000 people and only three, Quincy, Davenport, and Dubuque, with over 25,000 inhabitants. The same principle may be illustrated in other parts of the system. For example, Madison and New Albany, Ind., both declined in population between 1890 and 1900, and neither of them had 25,000 people in the latter year, whereas Indianapolis, preeminently a railway center, which in 1840 had less population than either of the towns mentioned and in 1850 almost exactly the same number, had in 1900 a population of 169,000.

So far as export business by way of New Orleans is concerned, the long roundabout journey, combined with lack of satisfactory steamship facilities at New Orleans, has had its influence in turning traffic eastward by rail.

The kind of business which has most satisfactorily developed on the Mississippi River system has been that transported in the form of rafts, the lumber business, and that handled by barges, of which coal is the best example. The former flourished on the upper Mississippi, and is still prosperous on the lower Mississippi and the Ohio and tributaries, because, as already indicated, it can be slipped into the water and carried to its market with little expenditure of labor and with no necessity of transfer. So soon as the forests were cut off on the banks of upper Mississippi tributaries, rafting began to decline, and a rapidly increasing proportion of lumber and log output was carried by rail.

The Ohio River coal traffic illustrates peculiarly well the kind and method of business to which the river system is at present adapted. In this industry, to be sure, are some of the advantages which are lacking in any other, namely, administrative organization, mechanical loading appliances, and the highest development of barge traffic. But in addition to all this, coal can be loaded direct from the mines into the barges and can then be transported without any rehandling to its destination, which is the river steamboat, the ocean-going steamship, the sugar plantation on the bay, or the railway coal yard on the river bank. In other words, the Mississippi can at present handle traffic successfully which begins and ends within its banks, but traffic requiring transfer to the railway at any point on its course will have a tendency to resort to the railway for the entire distance. Whether this situation is due to a control of terminal and transfer facilities by the railways and a refusal to pro rate with the waterway, whether it is due to lack of initiative on the part of river interests in developing transfer facilities, or whether it is due to the greater cheapness of an all-rail haul, the fact remains that carriage involving transfer no longer makes use of the Mississippi River system.

A recent special report of a board of United States engineers[1] calls attention, in explaining the insignificant commerce of the lower Mississippi, to the fact that the population in sections bordering the river is as low as 86 to 24 per square mile, including cities, and that in a total length of about 1,265 miles there are only seven towns or cities of over 10,000 population and only 23 of over 5,000 population. In reply to this and in answer to the statements which picture the declining condition of river commerce the advocates of waterways insist that if they were given an improved channel commen-

[1] H. Doc. No. 50, 61st Cong., 1st sess.

surate with the needs of business, traffic would come and the thinly settled sections along the rivers would be built up. They also contend that even if commerce were not developed by the waterway the existence of a waterway ready for use would so affect railway rates as amply to justify the expenditure for construction. This last contention may be dismissed with a few words. No expenditure by the National Government would be justified for the construction or improvement of a useless or idle waterway unless the saving could be clearly demonstrated in advance. Such a demonstration would, in the nature of things, be quite impossible, for it is evident that the comparative attractiveness of rail and water routes is not a simple question of comparative rates. A variety of factors which can be summed up in the word "serviceability" actually determine the method of shipment, and such factors can not be predetermined. If the purpose is to reduce railway rates, there are more direct and less costly methods of accomplishing this result.

The influence of a waterway in developing traffic is somewhat problematical, and no final answer can be given to the claims of those who insist that trade will follow the lock and the dam. Although there are real obstacles at present to successful navigation, as already noted, nevertheless it is difficult to understand why the commercial interests, if they are so eager for a waterway, have not made better use of existing facilities. The inference is a natural one that the trouble lies elsewhere than in the condition of water navigation.

But it must be admitted that there is some basis for the contention that good traffic facilities develop traffic. The truth of this has been often demonstrated by the railways. The waterway advocates have reason to count upon a repetition at least in part of railway experience, but hardly to the extent claimed by some of the extremists among the supporters of the policy. They have, however, the right to a reasonable assurance that such improvement work as is now being carried on and such plans as have been undertaken for further betterment shall be continuous, in order that such investments as they may make in floating equipment shall not be lost by an abandonment of improvement work.

To four general influences, then, may be assigned the decline in Mississippi River commerce: First, competition of rail and lake; second, natural obstructions to navigation; third, lack of administrative organization of the water transportation business; and fourth, certain fundamental principles of traffic movement which under existing conditions work to the disadvantage of water carriage.

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# THE DANUBE-ODER CANAL

## ARGUMENTS AND COMMENTS

BY

INJ. JOSEF RITTER VON WENUSCH

[Translated by Miss Annie Brainerd]

WASHINGTON
1911

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# THE DANUBE-ODER CANAL.

ARGUMENTS AND COMMENTS

BY

Inj. Josef Ritter Von Wenusch.

## THE AGITATION FOR AND OPINIONS CONCERNING ARTIFICIAL WATERWAYS.

The very different and often far-fetched arguments and opinions as to the utility, necessity, and feasibility of a canal from the Danube to the Oder, brought forward by the advocates of artificial waterways in the discussion during the closing days of last year's session of Parliament, go to show that the most astonishing ignorance exists in regard to the nature and economic value of waterways, and that most of the assertions are based more on sentiment and desire than upon actual facts; yes, that even technical descriptions are not always correctly understood. Thus, for instance, real tons, tons-kilometer, absolute and relative traffic, are often thrown confusedly together in the comparison of different roads, thereby making the confusion of ideas even greater. As an introduction, therefore, we will begin by giving a short definition of these terms.

The number of tons dispatched, multiplied by the distance of transportation, reckoned in kilometers, gives the amount of ton-kilometers. The total number of given ton-kilometers of a road, divided by the number of kilometers in its entire length, gives the density of the traffic, or the specific traffic, or, as will be shown in brief, the circulation of freight or traffic per kilometer. Only this circulation of traffic per kilometer should be used in comparing correctly the traffic of different roads or canals with each other.

The same form should be used in connection with the number of passengers carried and the transportation of passengers per kilometer.

A clearing up of the confused opinions brought forward by both sides in heated discussions over the necessity and feasibility of artificial waterways should be gladly welcomed by the general public, for it has to do with so large an amount of money that the least miscalculation as to results would cause the State, already so heavily burdened, to suffer severely financially.

The author of the unlucky waterway bill of 1901, which owed its origin to politics rather than to a business need, gave expression to this fear, when he said only one year later that "any failure

in regard to carrying the interest on the large capital invested would mean a financial catastrophe for the State," to which a member of Parliament made answer a short time afterwards, that "now that the bill is passed there is no longer any question as to the ability of revenue to meet the expense—it is now too late—the Government should have raised the question as to revenue before bringing in the bill."

The people will have only their representatives to thank if they have to feel in their pockets for the money to cover the canal deficit.

For 10 years the advocates of artificial waterways have quietly and persistently sought to influence the public mind, and by constant agitation, through clubs, congresses, publications, and magazine articles, have won to themselves their support, so that it now seems to the laity as though a State without artificial waterways could no longer continue to exist, and especially in Vienna the phrase "cheaper coal" represents the hope of the populace.

The opponents of waterways, conscious of the superiority of railroads as a means of transportation compared to one no longer quite in keeping with the age, and only practical as an exception, under specially favorable conditions, have ceased to oppose vigorously the zeal of the canal advocates, so that a former Austrian minister was able to say to a professional railroad man, well known as a waterway opponent, that there must be some special advantages peculiar to the navigable canals, as even the opponents look on at the agitation for them silent and inactive.

The success of a few single canals has produced a certain canal fever in many places, and this has been fostered by the strongest, and, for the great mass of people, most efficacious (because not understood) slogans and catchwords, and as nothing is too absurd not to be believed if only it is persistently and impressively repeated over and over again, so these have won over a large part of the populace to this great work of civilization—the Danube-Oder Canal—for, as they say, the technical part is not impossible, and the question of a revenue to carry out the same is quite beyond doubt.

Others again consider it childish and quite superfluous to ask that the revenue should be expected to pay interest on such a gigantic sum, and look upon it as a bad mode of procedure, for the indirect advantages, through the creation of new branch industries, etc., would outweigh any possible disadvantages.

One might expect such views from people uneducated on the subject of economics, but what shall we say when a professor in a public speech makes the naive remark that "one does not ask about the cost of repairing or replacing public highways." These are works of construction, however, which in proportion to their length do not cost the one-hundredth part of the Danube-Oder Canal. One can only regret that the minds of young students should be perverted by such teachings, which in later years will bear fruit in all branches of the public service.

A few years ago the talk was only of a Danube-Oder Canal from Vienna to Oderberg and thence to the Oder in Prussian-Silesia. Suddenly the project changed into the building of a canal from Oderberg to Krakau "in order to arouse Galician industries," and the earlier plan of connecting with the Oder in Prussia, formerly

described as highly important for Austrian trade and as really indispensable, was let drop.

The cause of this was that, according to the Prussian waterway bill, which was accepted without question in all quarters, the Oder and all waterways lying east of Berlin admit of only ships of 400 tons burden, whereas with us it was strenuously maintained that ships of 600 tons could be carried over the Oder and its tributaries. The vision of a direct waterway communication from the Baltic to the Black Sea seems to have knocked the former canal proposition quickly out of mind.

In each one of the different projects for a Danube-Oder Canal brought up during the past 40 years, the cost of the work has noticeably increased, and indeed this variability as to cost—for each of which a quite exceptional revenue has been calculated—is a highly suspicious indication.

It shall be the aim of this paper to examine into the real meaning of certain phrases and rallying cries on their own merits, and to give the public a true statement based on facts, not on hopes and expectations, for only facts and figures can be accepted as strong enough to demonstrate the value of so important a matter.

The technical side of the Danube-Oder Canal will not be touched upon here—whether to have ship lifts or locks, whether to have few or many locks, etc., whether the depth of the water shall be greater or less, whether the ships shall be of 400 or 600 tons burden, whether the construction will be difficult or not—all these questions must remain unanswered; they are only questions of money. All are practical and all have been carried out. Here we will discuss only the economic side of this expensive project which, for the practical business man, is the only correct rule with which to measure the justice of the matter; all else is mere talk and self-delusion, or else, what is much worse, deception of the great general public, the taxpayers.

## NATURAL AND ARTIFICIAL WATERWAYS.

The principal cry used to prove the need of a Danube-Oder Canal and other navigable canals is that Austria is very behindhand in regard to waterways, and in view of the vigorous competition between countries ought not to be allowed to remain behind.

According to statistics of the estimated traffic of different countries, France possesses 12,080 kilometers of navigable waterways (1905)—that is, regulated rivers, canalized rivers, and navigable canals; Germany has 11,606 kilometers, not including harbors and seas (1907); Great Britain and Ireland, 6,287 kilometers; and Austria, according to "Luppan," 6,489 kilometers, not including seas. These figures must awaken in the minds of many the thought that perhaps the incorrect statement brought forward, intentionally or unintentionally, by the advocates of waterways—i. e., that Austria possesses the fewest waterways and therefore "should be strengthened in the battle for trade" by the building of very expensive artificial waterways—is perhaps correct.

The great difference in the total length of the waterways of these countries is only seemingly to Austria's disadvantage, for, as in the case of railroads and highways, the correct estimate of the length of

these various roadways is not by their absolute length—for a large civilized country would have a greater total length of roads than a small one—but rather is it the relative length; that is, the length of the roadway compared to a certain extent of territory—for instance, to an area of square kilometers—and only these relative figures would give a correct measure for comparison.

If this relative value is ascertained we find that the average amount of waterways to the square kilometer is 22.52 meters in France, 21.49 meters in Germany, 20.02 meters in Great Britain and Ireland, and 21.63 meters in Austria.

Austria, therefore, compared to other European countries, does not stand so far behind in regard to length of waterways, but seems, rather, in spite of the unfavorable condition of the country, to hold a foremost place.

Should we, moreover, in order to have a more uniform basis for comparison, include a part of the high Alpine country—for instance, the Glockner and Tauern and Venetian territories and the Dolomites, where there are many very large and beautiful streams—in all about 10,000 kilometers, but naturally no navigable waterways—Austria would seem to have even more waterways than Germany and nearly as many as France, namely, 22.37 meters per square kilometer.

Austria is, however, very far behind many much smaller countries—for instance, Switzerland, Sweden and Norway—in the intensive use of the water power of the great rivers and streams which nature has so plentifully bestowed upon her, as well as in the use of her numerous and magnificent waterfalls.

The lack of enterprise which the Austrian manufacturers and people of wealth have manifested in this matter, doing so little on their own initiative and trying always to obtain everything at the expense of the State, is a crying shame.

The Moldau and the Elbe, though showing a considerable traffic during the past 10 years or more, have only recently been canalized, and then only on a small portion. The March gives a practical waterway from the most inland part of Moravia to the Danube and thence to Vienna, and provides for the "opening up of a multitude of still undeveloped natural resources and raw products" for which, according to the canal advocates, "the great navigable waterways," i. e., such as carry ships of at least 600 or, better still, 1,000 tons burden, would be especially adapted. Up to the present time, however, the March is only a wild and uncontrolled stream, of which one would rather be rid, although for 30 years streams of ink have flowed and numerous interminable speeches been made concerning the project of its regulation. It has at present only a geographical significance as making a part boundary against Hungary, which has perhaps been a hindrance to its regulation.

In France, Germany, and England a great number of rivers of very secondary importance have for over 100 years been regulated and canalized, and a regular uninterrupted traffic has followed. That one should, however, build canals of the largest dimensions, spending many hundred millions of marks, the interest on which could not be expected from the traffic for 10 years at least, and which would therefore constitute a heavy burden for the State, and begin the

development of waterways backward, so to speak, is one of the incomprehensible things in which Austria abounds.

We have, indeed, enough natural waterways, but none, or only a very insignificant, traffic upon them (as is also the case on most of our railroads in comparison with England, Germany, and France), and the building of many canals, at an expenditure of many millions, will not help matters. Our magnificent Danube had a lively traffic before the time of the railroads; to-day, compared with the German and French rivers, it is quite unimportant. It lacks up-stream the natural resources which give rise to an active trade and these should first be discovered and investigated.

If coal fields lay at Passau, as they do midway up the Oder in Prussian Silesia, and midway up the Rhine in the Ruhr district, the traffic on the Danube would be as active as on those rivers.

Galicia has important natural waterways. They are, however, only regulated and used here and there, and therefore are of but little value; moreover, because of their high water and unregulated course, they destroy every year many millions worth of national wealth.

Almost all the great rivers of Galicia flow toward Germany and Russia. Very little is said by our canal friends, however, concerning their insignificant traffic and the cause of it, in spite of their favorable position. A betterment of their condition for navigation would help but little, for in order to develop traffic on them it would not be enough to increase the production of raw material and home industries; markets also must be acquired. The Poles, for national reasons, will have nothing to do with Germany; they even try to boycott German importations. It is very likely, therefore, that the Germans would retaliate against the importation of Polish products. As for Russia, because of her rapidly increasing home production, it is to be feared that within a few years not only her importations of Polish and Austrian products would be given up, but even that she would seek to turn large quantities of her own productions into Galicia.

### TRAFFIC ON THE AUSTRIAN WATERWAYS.

A very valuable article of Krickl's in the statistical monthly paper of the year 1907 gives the total traffic on the Austrian natural waterways for 1903 as 7,454,453 metric tons and about 465,000,000 ton-kilometers. That is very little, to be sure, in comparison with the 10 or 20 times greater water traffic of France or Germany, but the geographical conditions of those countries, as well as their national, industrial, and commercial conditions, are much better than with us; and at a time when their industry had been highly developed for many years, ours was still in its infancy, and it is difficult to overcome such a handicap. A large commerce can not be suddenly obtained by force; it must be based on sound natural economic foundations and be gradually developed by the careful fostering of years.

As pointed out, therefore, Austria is not behindhand as to the length of her waterways, but only as to the use made of those she has. She is behind in other things also—things which could be improved much more cheaply, more easily, and in a more rational way—first among which are the railroads.

### THE UNDEVELOPED STATE OF RAILROADS IN AUSTRIA.

Austria has only 72 meters of railroads per square kilometer of land, whereas France has 89 meters, Germany 106 meters, Great Britain and Ireland 118 meters, and even Switzerland, the most mountainous country of Europe, 104 meters per square kilometer.

In order, therefore, to reach the same degree of development as Germany, we must build some 10,000 kilometers of railroads; as France, 5,100 kilometers; and as Great Britain, 14,000 kilometers.

As this can not be done at one stroke, and as all three countries—Germany especially—are making the greatest efforts to continually extend and complete their railway systems, we shall probably remain behind for all time. The Prussian Government has within the past few weeks (1909) brought forward a preliminary report for the building of additional railroads at a total cost of 138,000,000 marks, by means of which her net of railroads would be enlarged by about 1,700 kilometers.

It would therefore be much more to the purpose and would greatly help not only Moravia, Silesia, and Galicia, but all the provinces, if the many hundred millions proposed for the Danube-Weichsel canal should be turned toward the enlarging of our network of railroads and highways.

Passenger traffic would also be increased by an extension of the railroads, which in turn would increase the activity and revenue of all the principal connecting roads, a thing impossible to accomplish by canals, and which, nevertheless, is of the highest importance, as we are very much behind the before-mentioned countries in passenger traffic, in spite of our cheaper passenger rates.

In order to bring about a reasonable water traffic the existing rivers and streams must first be regulated; safe and constant navigable channels made and maintained, and a traffic for them created by carefully fostering industries and the production of raw materials. Then, only, should these rivers be entirely, or in part, canalized in order to improve navigation, and finally the different natural waterways which are separated from each other should be joined together in a connecting link by means of artificial navigable canals.

This natural procedure has been followed in France, Germany, England, and all over the world for over 100 years, whereas with us we are beginning backward—with the last link in the chain of waterways; i. e., with the hugely expensive "great navigable canal," with ships of 600 tons, and want to connect the Weichsel with the Danube, one of which has no traffic and the other only a very insignificant one. Moreover the increase of native production with us has been limited because of the constant quarreling between the people of the two nationalities.

### PREDILECTION FOR CANAL BUILDING.

Another reason frequently brought forward in favor of canal building is that other countries—especially Germany and France—are trying to outdo each other in the construction of artificial waterways and show a special predilection for canal building.

In Germany well-regulated navigation of rivers and streams has been carried on for over 100 years, and she has a systematically laid out network of canals to connect them. Even small, little-known

rivers, like the Saal and the Ruhr, were already opened up for ship traffic as early as the end of the eighteenth century—the Lippe in 1830, the Lahn in 1842, the Ems in 1846, etc. The Finow Canal existed as an important link between the Oder and the Havel as early as the seventeenth century. The Friedrich Wilhelm Canal, which connects the Spree with the Oder, was built between 1878 and 1891 for ships of 400 tons. The Bromberg Canal has been in use since 1770, etc.

There is scarcely another country in the whole world where the natural conditions are so favorable for the construction of artificial waterways as in Germany, especially in the northern part. Five great rivers of from 500 to 700 kilometers in length—that is, nearly double the distance of the Danube from Passau to Presburg—alive with traffic, run almost parallel into the North and the Baltic Seas, and possess such a far-reaching commerce that it is of the utmost importance that they should be connected by large navigable canals in order that the commerce from one river can be carried directly over to another.

With the immense private business in Germany it is necessary that the coal from the Ruhr mines—the greatest coal district of the continent—should be distributed throughout the different districts, and also that it should be transported direct to the sea without re-lading, in order to keep out the English coal from the German seaports, which, from a German point of view, is very important.

According to German Government statistics 26,300,000 tons of English coal valued at 370,000,000 marks were imported into Germany from 1904 to 1906, inclusive.

The importations of Swedish ore and Norwegian timber for use in mines is indispensable for the steel and iron business of Germany (which is the greatest in the world next to that of the United States), and can be brought in most cheaply over these natural and artificial waterways, as a convenient return freight for the coal brought to the seaports.

The plains of north Germany contain a wide stretch of moorland, and a great ramifying network of drainage canals is of the utmost importance in order to render them suitable for cultivation. Such large drainage canals can, at comparatively little additional expense, be easily converted into navigable canals, and thereby two great objects would be attained.

Neither with us nor elsewhere are such highly favorable conditions to be found.

## DRAINAGE AND IRRIGATION.

To a student of parliamentary affairs it would seem as though the seemingly irrelevant assertion made in the House of Delegates that "by the building of this canal 200,000 ha. (hectares) of swamp land would be drained," had been brought forward merely to prove and make very apparent the urgent need of a Danube-Weichsel canal.

One can easily get an idea of the extent of such an area, if one measures it by the length of the canal, i. e., 400 kilometers. It would then give an average width of 5,000 meters of swamp land on the entire length.

According to the Austrian Handbook of Statistics for 1906 (p. 141) there are, however, in all of Austria only 106,445 ha. of lakes, ponds, and swamps all counted together. Of these 1,956 ha. are in Lower Austria; 4,541 ha. in Moravia, 149 in Silesia, and 20,859 ha. in the whole of Galicia, making a total of 27,505 ha. According to the statements of the delegates, therefore, there would be more than seven times as much swamp land just along the Danube-Oder-Weichsel Canal!

With such false cries and phrases do they seek to lure the agriculturist, to whom the drainage of so many swampy fields would certainly be desirable.

While the advantages of drainage are pointed out by some, others give the hope of protection against floods and plentiful irrigation in dry seasons through the important regulation of the March and Thaya, in connection with the construction of the canal, which, however, would not be the case, as in dry seasons the canal itself will need all the water collected in the reservoirs, and not a drop will be left for the use of the agriculturists unless, indeed, they build their own reservoirs, which they could do without building canals.

As for the regulations of the Moravian rivers, that is only a side issue of the canal project—not part of the canal construction itself—and could have been carried out at any time quite independently.

"Drainage," "irrigation," and "protection against floods by the regulation of the March and Thaya," all in one breath!

Nördling, in his speech before the Austrian Railroad Officers' Club in 1885 on the question of waterways in that day, designated these slogans—popular even 35 years ago—as "pure imagination." Nördling remarked further that the experience of France for over 100 years had shown that on the contrary there were complaints that canals either swamped or drained too dry the country bordering on them. If the canal lies in a deep cut it is apt to sap the underground springs, if it is built behind dikes and is not very carefully protected it seeps through and turns the surrounding country into a marsh. To make the channel safe and secure constitutes a not uncommon difficulty in the construction of a canal, and because of the great size and great flow of water and the sievelike floodgates of the locks long stretches of the Danube-Oder Canal would be very difficult and expensive to build.

Nördling especially warns against following the example of France any longer in the matter of waterways.

## THE WATERWAYS OF FRANCE.

Up to the most recent times French waterways have been held up with great satisfaction by the followers of artificial waterways as well worth our imitation. The difference between the economic and business conditions of the two countries makes a comparison utterly inadmissible.

As early as the year 1600 France possessed 156 kilometers of navigable canals; in 1700, 678 kilometers; in 1830, 2,120 kilometers; and in 1847—therefore, before the time of railroads, properly speaking—3,750 kilometers of canals and 6,700 kilometers of navigable rivers and streams, which altogether had a total traffic of 1,813,000,000 ton-kilometers.

We had, before the time of railroads, but one canal of 67 kilometers in length. Toward the end of the eighteenth century Vienna built the Vienna-Wiener-Neustadt Canal which, after being used for 70 years was given up because of its small traffic. According to canal men it was built of too small dimensions. In France, however, there are many old canals of the same dimensions which, nevertheless, have a comparatively large traffic; for instance, the canal from Berry, of 261 kilometers, with a traffic of 260,000 tons, and the slightly larger Ourcq Canal, 108 kilometers, with 150,000 tons.

Only about one-fifth of the French canals were in the hands of the Government before the era of railroads, the rest in private hands, as in those days canal building was still considered a paying business because of the high canal rates. The cost of building was so small that one wonders how the railroads, which cost twice as much, could ever have spread so rapidly.

The old French canals cost about 176,000 kronen per kilometer, the new ones from 270,000 to 320,000 kronen. The cost of canalizing rivers was only 72,000 kronen per kilometer up to the end of 1870, whereas the average price of the 39,000 kilometers of railroad—notwithstanding the numerous cheap local roads—amounted to 318,000 kronen in 1905. Some single railroad systems are more expensive; for instance, the 3,700 kilometers of the French Northern Railroad is estimated at 456,000 kronen, and each one of the 9,300 kilometers of the French Mediterranean Railroad at 415,000 kronen per kilometer.

According to a statement in the Zentralblatt der Baumwoltung by the Prussian minister of public works, most of the canals in Alsace-Lorraine were built during the first half of the last century under the French régime at a cost of 180,000 marks per kilometer, and amounted in 1883 to about 420 kilometers, whereas the railroads then in use had cost 243,500 marks per kilometer.

There is a very striking difference between these figures and the great cost of the Danube-Oder Canal which, according to authentic statements in the report of the central committee on rivers and canals in Austria, would cost 910,000 kronen per kilometer. It will doubtless even be difficult to hold to this amount, as in the 8 or 10 years during which the canal will be building conditions may arise which can not possibly be foreseen. The very unfortunate experience which has taken place in the construction of the works for protecting the valley, and which, we understand, may increase the original estimate 50 per cent, suggests similar experiences in other places on the canal.

According to Nördling, the canals in France increased about 110 kilometers during the years from 1870 to 1884, and the railroads about 13,243 kilometers. The greatest increase in canals took place between 1820 and 1850, during which time about 3,000 kilometers of new canals were built. The total length of these canals in 1850 amounted to 4,250 kilometers. The railroads, which in 1839 had a length of only 248 kilometers, whereas the canals amounted to 3,600 kilometers, increased so rapidly that by 1854 they attained a length of 4,300 kilometers. From this time on the railroads increased rapidly, while the canals increased but slightly, and by 1903 the length of the former was 45,000 kilometers, while the latter was only 4,850 kilometers.

In spite of these century-old canals the foreign commerce of France, which is closely connected with the development of business

and industry, has increased but little, although France, because of this far-reaching network of waterways, has the advantage in competition with other countries—even with England herself.

With the introduction of railroads a sudden and great change took place in business life, which still continues in proportion to the growth of the network of railways.

In course of time the French Government bought up nearly all the private canals, and at the present time has almost completely redeemed the whole system of canals, which are toll free for everyone, without any special tax.

Private capital no longer sees any business profit in the construction of new canals; they only furnish the Government with an effective means of combating the six great and powerful railroads, which are fast becoming a monopoly.

In Austria, where in a short time nearly all the important railroads will be in the hands of the Government, it would certainly be a waste of the national wealth to spend many millions of crowns on navigable canals in order to fight the rates on Government railroads.

The example of Germany, especially of Prussia, where side by side with a far-reaching network of railroads, a great number of navigable canals also carry on a lively traffic, does not apply to us, for reasons already partly given and which will be still further discussed.

### COMPETITION BETWEEN CANALS AND A SECOND NORTHERN LINE.

Wherever the construction of artificial waterways is contemplated, one of the most weighty arguments in favor of it is that "railroads can not compete successfully with canals, either in their capacity or cheapness as carriers." That argument is the little scarlet thread which runs with many a twist and turn through all the discussions over waterways, and because of the seeming truth of its fundamental principle has won the greatest number of adherents. In order to show up the falsity of these well-rooted beliefs concerning the superiority of artificial waterways, a complete exposition of all the conditions is necessary.

When a comparison of these two utterly different means of transportation is to be made, the cause of the traffic carried to and fro, and for which the road exists, must first of all be stated.

The closely connected question as to whether, under certain conditions, a railroad could be so built as to be peculiarly fitted for cheap freight transportation, and even superior to a canal, is usually passed over by the friends of waterways or is answered by a plain "no."

When a large number of influential people and people of authority are held together by this little word, it must exercise a powerful influence on the general public.

A railroad is expected to render a punctual, quick, and uninterrupted service during the entire year. With a canal, if the traffic is tied up for weeks and months in summer or even more in winter; if freights have to be reladen two or three times; if it takes weeks instead of days to transport articles a given distance; and if delays and irregularities occur which on a railroad would not be tolerated, it is calmly accepted as inevitable.

The business world has gradually become accustomed to these drawbacks, but it is often a question whether the slight difference in the cost of shipment is sufficient to outweigh the many disadvantages. So far only the advantages have been heard of, but many seemingly fine things theoretically prove much less fine in practice.

It is evident from the following extract that the disturbance to trade, because of repairs on the canal during summer and ice during winter, may be very considerable. In Das Schiff, a Berlin periodical published in the interest of waterways, in March of this year, it says: "The Dortmund-Ems Canal was closed during the first weeks of March, 1909. Not for years has the winter closing of this canal proved so disastrous to trade. Many business concerns suffered a loss of 100,000 marks because of it." It will take these business concerns many years of the most careful work to make up this loss, if, indeed, they ever sufficiently recover to again be able to use this uncertain means of transportation, which depends so entirely upon wind and weather—and right here let us say that the winter climate on this canal is much milder and better than it would be on the Danube-Oder Canal. How, then, would conditions be here?

Our railroads must have express trains, passenger trains, combined local and through trains, fast and slow trains, etc., and must dispatch all these different kinds of trains on different degrees of speed and with different kinds of transports. This alone should explain the lesser freight capacity, the greater business outlay, and the higher rates on railways, if interest is to be paid on the capital invested. And here, once for all, let it be stated that in a healthy business enterprise, one not based on mere words, this is always presupposed.

If a second Northern line should be built, entirely independent in operation from the present Northern road, and therefore laid at a certain distance from it and only connected at the larger trade centers; and if it should serve no passenger, fast-express, nor small-goods traffic, which would make the building of the road much more simple and the operation much cheaper; if the speed of its trains could be lessened and special arrangements made for the transportation of freight, which would only occasionally be transferred to the connecting roads, usually merely transshipped, as on the canals; if, in a word, it had only freight to handle and in very stormy weather the trains could be discontinued in order to save hundreds of thousands of crowns for the clearing away of snow,[1] then it would be possible for it to carry not only a much greater amount of freight than the canals, but also, under such conditions, at a lower rate, without being obliged to pay out hundreds of millions of crowns, because such a road, built with double tracks for the greatest possible amount of service, would cost hardly half as much as a canal and a single-track one scarcely a third.

In the report (No. 96) laid before the Prussian Parliament by the Government during the session of 1904–5, the cost of transportation on the new ship canals is given as 0.6 to 0.8 heller for the operation and maintenance, and for interest and payments on capital invested a tax of from 1.22 to 2.28 heller, according to the amount of money invested, making a total of from 1.82 to 3.08 heller.

[1] In 1906 the Kaiser-Ferdinand's Northern Railroad paid out 214,000 kronen for clearing away snow; the Austrian State Railroad, 1,700,000 kronen; and the railroads in Austria all together, a total of 2,400,000 kronen.

According to a detailed statement, which unfortunately can not be given here on account of lack of space, a "freight railroad" with a traffic of 2,000,000 tons-kilometer can carry freight at from 1.5 to 2 heller per ton-kilometer—therefore much lower than the canals—and pay full interest on the investment. A comparison with the Danube-Oder Canal can not, unfortunately, be given, as the canal rates—the most important and fundamental part of a waterway statute—have not yet been decided upon.

As for the carrying capacity of a Danube-Oder Canal or a freight railway built only for bulk freight, the greatest capacity of the former is known in general from the discussions in Parliament, and the yearly circulation is given at 5,000,000 tons. Whether this gigantic traffic can be expected within a reasonable length of time is another question which will be carefully considered later. Meanwhile we may assume that it exists for either means of transportation.

A double-track freight railroad with heavy rails and heavy locomotives, with cars of from 20 to 30 tons capacity (which would mean shorter trains and fewer stops), instead of our usual 10 to 15 ton cars, with brakes connecting through all the cars so as to diminish the number of train hands (as has been the custom in the United States for many years), such a line, belonging to the Northern Railroad and dispatching trains every 12 to 15 minutes, with the same rates as those computed for the Danube-Oder Canal, and which would go fully laden in the direction toward Vienna, and one quarter laden in the opposite direction, would be in shape to carry from eighteen to twenty million tons yearly over the entire length of its road—that is a theoretical circulation of from 18 to 20 million ton-kilometers per kilometer of the road's length—nearly twice as much as the Danube-Oder Canal.

Even a single-track road, with stations at virtually the same distance apart—that is, about 10 kilometers—and with a medium speed of about 25 kilometers, can under similar conditions carry at least from 5 to 6 million tons. With stations at such a distance apart, a train, at such a speed, would take 24 minutes from station to station, the return train taking the same length of time. The trains can, therefore, follow each other every 48 minutes. In 24 hours, counting the necessary stops, 25 double trains, or in 360 working days 9,000 trains, can be dispatched in each direction. If one reckons, therefore, that a train going to Vienna—that is, in the direction carrying the heaviest freight—with only 500 tons, and in the opposite with one-fourth the amount, one gets a possible circulation of 5.6 millions a year, or more than on a canal.

This capacity, however, does not indicate the maximum, and could be greatly increased by using heavier locomotives, by sending the empty cars back in double trains, etc.

The Pennsylvania Railroad carries freight trains of 1,076 American tons—equal to 977 Austrian tons—nearly 400 tons more than on a canal and twice as much as on the "freight railroad" described above. This road has a traffic in coal of 49,000,000 tons; that is, as much as all the traffic on the French railroads and waterways taken together.

The carrying capacity of a canal, therefore, which is pointed out as something extraordinary because a fully laden boat holds as much as two ordinary freight trains, is by no means very extraordinary.

and can even be surpassed by a railroad built only for freight transportation.

Half of the 1,833,000 freight cars in use in the United States have a capacity of from 20 to 30 tons, a third of from 30 to 50 tons, and the immense traffic on many of the American railroads would be simply impossible with our carrying facilities. For the last two years some American roads have even had coal cars of 90 tons capacity.

During political disturbances, which in the recent case were of short duration but which are liable to return in a few years, a railroad of such tremendous carrying capacity would be of the utmost strategical value, and might be the determining factor in the successful outcome of a war. From this short sketch every unprejudiced person will be able to perceive the great advantages and the great carrying capacity of a freight railroad.

The only question is whether a traffic gigantic enough to warrant the establishment of such a road could be expected within a few years, and the same question applies to a canal.

The principal factor which reduces the freight capacity and lowers the net receipts of our great railway lines is the passenger traffic, which fact can easily be proven from statistical statements.

Of the total train movement on German railroads, 370,000,000 train kilometers, that is, 60 per cent of all trains moved, are for passenger traffic. In Austria it is 57 per cent. On the Bavarian and Württemberg Railroad this per cent reaches 67 and frequently 69. The same division is noticeable on the principal French railroads, where 66 per cent serves passenger traffic and 34 per cent freight. On the English roads, which show in general the greatest traffic both passenger and freight, and where the per cent for the former on some of the great lines of 1,000 or 1,500 kilometers in length amounts to even 80 and 83, the case is the same. This gigantic passenger traffic is made possible partly because of the tremendous speed of the English trains and partly because the design of the English roads is very different from that of the continental.

If this immense passenger traffic were done away with and supplanted by freight, one can see that a three or four times greater quantity could be cared for, as is the case already on many stretches of road, where the limits of carrying capacity are so distant that the proposed canals, usually with many locks, could never hope to equal them. Because of this far-reaching passenger traffic the movement of freight cars is limited, and accomplished only at great loss of time and money, and necessitates the provision of numerous train yards. The slightest delay of a passenger train may lead to the delay of a freight train for hours, even for half a day, if the safety of the public is fully guarded.

On the Prussian State railroads, which are the best managed and which yield the largest revenues of any in the world, according to a statement of the Prussian privy counsellor, Schwab, which appeared recently, freight cars "can not spend more than 3 hours daily on the transit itself; the remaining 21 hours they must remain tied up in the stations doing nothing. Therefore train yards must be continually increased and made larger."

Another important advantage to be considered in connection with a freight railroad is that it need not be completed in all parts at

once for the entire traffic to be expected, but can be built gradually with the proceeds gained, growing, as it were, with the traffic. Stations, storehouses, roundhouses, etc., can at first be built of modest dimensions, sidetracks can be laid in the simplest manner, and the number of persons employed in the operation of the road can be reduced to a minimum, thereby using the least amount of capital possible.

A canal, on the other hand, must from the very first be prepared to handle as large a traffic as is ever to be hoped for—and often this expectation is not realized for years—and the immense capital invested carries an interest which is a financial burden from the start. A freight railroad, which would give cheaper rates on bulk freight, would be better and more economical than any canal, for it could be used equally well in both summer and winter, and could be built in 2 years; whereas a canal would take from 8 to 10 years to build, would not yield a net income for many years, and would require many million crowns more interest. One can only wonder why such freight roads are not built, and why so many artificial waterways are in use in Germany and France.

Of course the question can not be answered for all countries and places alike, and the superiority of the one or the other mode of transportation can only be decided in each case with reference to the general conditions of territory, place, and traffic.

In France no new canals have been built for many years, except such as complete or shorten a route on those already in existence. In Germany, especially in North Germany, the conditions are so different from those of any other country that one can say with truth that there canals can often be built cheaper and more to the purpose than railroads. The so-called Central or Midland Canal has an uninterrupted length of 174 kilometers—that is, has no locks for that distance—and can, therefore, theoretically handle an unlimited traffic, ship following ship back and forth like clockwork. Besides that, it serves the other important purposes already mentioned.

Another similar example held up with enthusiasm by all canal advocates is the Teltow Canal, running south from Berlin, and built by the district of Teltow from its own funds without assistance from the Prussian Government.

This canal, 40 kilometers long, cost 1,000,000 marks per kilometer and affords a direct navigable route from the upper to the lower Spree, avoiding the 13 kilometers of circuitous travel through Berlin, besides thoroughly draining the wide stretch of surrounding swamp and moor land and rendering it fit for cultivation. This drainage of the country is expected to so increase the value of the land, because of its proximity to Berlin, that it is hoped the increased ground tax alone will cover the interest on the investment. In neither of these cases could the same advantages have been procured from a railroad. These are exceptions which are not often found.

On the whole one can say that the time for real freight railroads has not yet arrived, but that owing to the rapidly increasing growth of population and consequent increase in passenger traffic it is not far distant, and that not only is the ultimate complete separation of the passenger and freight service inevitable, but also that when that comes about electricity will probably come into use for all passenger trains.

In the meantime we must be content with an extra third or fourth track for the heavy increase in freight, which, however, is a weak, palliative measure, and, as shown from railroad statistics, can only be used in a few cases.

The Prussian State railroads have only 204 kilometers of three or more tracks; that is, only 0.58 per cent of their total length; the principal French roads have 60.5 kilometers or 0.15 per cent of four or more tracks in the vicinity of Paris; some English roads are laid with four or more tracks on 5.5 per cent of their length. As a rule, however, it is preferable to build entirely new lines. Five different railroad lines run from London to Liverpool with a daily total of 55 express trains.

### DISADVANTAGES OF PASSENGER TRAFFIC.

A single passenger train inserted in the service of a freight railroad would seriously affect its capacity for freight carriage. This could be seen at a glance from any statement of a railroad's traffic. The introduction of a sixth express train on the (Kaiser) Ferdinand's Northern Road, after it was taken over by the Government in order to favor a certain political party, was followed by the dropping off of six freight trains, and, combined with the disadvantage of the change from commercial to bureaucratic management, was the chief cause of the disturbance to freight traffic. The six freight trains which were dropped could under ordinary conditions care for a circulation of traffic of a half million tons in 300 working days.

The dispute between those in favor of canals and their opponents which has been going on for 10 years has brought about a very one-sided and superficial criticism of these two totally different methods of transportation.

The advocates of artificial waterways, with an utter misunderstanding of the great advantages of a railroad built only for freight, have given the preference to canals from purely private business reasons, and have attributed to them advantages which they really do not possess. A perfectly impartial solution of the question, and one free from all criticism, could only be arrived at through a scientific exposition of both projects, and a full presentation of all the economic advantages of both railroad and canal.

Economic questions should not be judged from a sentimental standpoint, but with a cool, sober understanding of the matter. The question of cheaper rates is closely connected with the question of the carrying ability of canals and freight railroads, and really finds its solution in the latter.

It is a well-known fact that passenger traffic on most roads is passive—that is, that it often does not even cover the cost of operation and yields little or nothing for interest on capital, though a large amount must be invested for its equipment; so that when interest is paid on a road it must be gotten entirely through freight traffic. That the freight rates, therefore, must be correspondingly high, is self evident. The Württemberg State railroads have made a most careful and exhaustive examination of the subject, which makes it apparent that the reduction of passenger rates, so greatly praised as a social-political act, is merely a shifting of the difference in income to the shoulders of the taxpayer in general, and to industry and business, through higher freight rates, in particular.

Every mistake in business policies brings with it the most far-reaching and often disastrous results.

### AVERAGE RATES AND BULK FREIGHT.

The average receipt for 1 ton-kilometer of freight, or the average rate per ton-kilometer from all receipts for the total amount of freight is, with us, as on many other roads, very light; that for a passenger per kilometer much too low. The average rate on the Austrian State railroads is 2.73 heller for a person and 4.13 heller for a ton per kilometer. In the United States and in Canada it is just the reverse.

According to statistics of the United States the average rate on all railroads (reckoned in our standard) is 2.44 heller per ton-kilometer and 6.3 heller per person per kilometer. On the roads lying east from Chicago 1 ton-kilometer costs only 1.86 heller, or less than half with us; for bulk freight on long distances the rate drops as low as 0.63 heller.

The Chesapeake & Ohio road has a rate of 0.63 heller per ton-kilometer for coal. The Pennsylvania road, 2,900 kilometers long, one of the most-used roads in North America, and the Baltimore & Ohio road have similar rates; whereas on the Erie Canal, often called "free" by the canal partisans, a freight rate of 0.68 heller per ton-kilometer is charged. According to a well-edited and much-read American railway newspaper, the Railway Gazette, the State of New York, however, as owner of the canal, pays for maintenance and operation 0.47 heller for each ton per kilometer actually forwarded.

In England the passenger and freight rates are very high, otherwise it would not be possible for the English roads, which are on an average two and one-half times as expensive as ours, and in which 31,000,000,000 crowns are invested—nearly five times as much as with us—could pay interest. And yet they do pay a very good interest, according to the English money market; but England is the largest industrial and commercial country in the world.

According to the German Journal of Inland Navigation (Zeitschrift für Binnenschiffahrt) for 1908, the yearly report of the Central Commission for Toll-free Rhine Navigation gives the following freight rates:

For coal from Ruhrort to Mannheim, a distance of 352 kilometers, 0.7 pfennig per ton-kilometer (or 0.82 heller); from Ruhrort to Karlsruhe, 421 kilometers, 0.7 pfennig; from Rotterdam to Mannheim, 566 kilometers, for bulk freight, 0.66 pfennig (0.77 heller).

That is about the cheapest rate on Rhine transportation, and it is, on the whole, higher than the American railroad rates for heavy freights as given above. In these railroad rates lies, in great measure, the business superiority of America over Europe.

In wealthy France and in thrifty Prussia the State railroads are anxiously watched both by the Government and by the representatives of the people to see that they pay a proper interest. It is the view of all prominent economists and a precept of governmental justice that not only should single groups of interested people, but rather the whole general public, benefit from the Government expenditures for public transportation facilities. For that reason Prussia desires, rightly, to introduce navigation tolls on the hitherto free

Rhine and Elbe, the care and maintenance of which demand large expenditures of money.

With us this sensible and just basis for a Government undertaking is pushed entirely aside. We pass lightly over it with meaningless figures of speech. Any effort to make a Government undertaking pay interest would be pointed out as a prejudicial and "hateful fiscal policy." The general public will be led astray by the catch words of "Economic Return," or a return in the higher sense, i. e., in the interest of industry and commerce. They will be led to believe that they will gain great advantages from the State through cheap rates, without remembering that every deficit in the Government funds, every shortage in the public treasury, must be met from their own pockets through increased assessments and taxes.

The extraordinary business of the railroads in passenger traffic is not in accord with their receipts. Whereas on all German roads 60 per cent of the total train service per kilometer falls to the passenger traffic, making the receipts for it amount to only 29.3 per cent of the total receipts, on the Austrian State railroads these figures stand 62.6 per cent of the train service per kilometer, and 25.6 per cent of the traffic receipts, respectively.

According to these statements, which are based on statistics, and which are the same on French roads, the assertion of the canal people that only canals can carry heavy freight in large quantities and at cheap rates is sufficiently refuted; and the contrary assertion that this is more simply and cheaply attained through judiciously built and managed freight railroads is sufficiently proved.

Each year the traveling public is transported more rapidly, punctually, comfortably, and safely, but it is willing to pay but little, though it complains loudly when any deficit on the Government roads is met by an increased taxation and unjustly lays the blame on the small amount of traffic.

Statistics show that the Austrian State railroads are among the most cheaply operated of all the great German and Austrian railroads; the contrary assertion therefore is nothing but one of those demagogical phrases by which one lays his own commercial sins on the shoulders of another, and thus misleads the masses.

The people think that they ride cheaply on the Government railroads, and do not realize that every deficit has to be met by higher taxes. With the left hand the State gives cheap transportation to every traveler on its roads, averaging 90 hellers per trip; with the right hand it takes from him 2 kronen 60 hellers in higher taxes to cover the deficit on the road.

The Viennese State railroad has a deficit of 13,000,000 kronen, not including the money paid out for interest. To cover this the taxpayer must pay 4 heller for every passenger carried.

### TRAFFIC ON FRENCH WATERWAYS.

One of the favorite, though most unfounded, assertions made by the canal advocates is that artificial waterways are specially adapted to the transportation of raw products of small value, and in this respect far surpass the railroads. The idea is even given that such freights can only be carried by boats, and, in fact, only by especially large boats. Wood, sand, clay, fertilizers, etc., are articles named as giving the preference to canals. The canal partisans speak also as

though these articles of little value were used in such large quantities that a great ship canal would have a very large amount of freight to handle from them alone and that business could not get on without such canals.

Apart from the fact that a boatload of 600 tons—that is, 60 full carloads—of wood, sand, or fertilizer would seldom be used by a single concern, and therefore the small business capital of most of our population would necessitate the interposition of a middleman—which the slight decrease in canal transportation would only foster—all these assertions as to the preference being given to canals can be completely refuted, as in spite of higher railway rates the contrary is often the case, and can be proved by the valuable and complete statistics concerning all kinds of canal transportation in France.

Even this proof is not possible, because on railroads other classifications or no classification of goods is kept, or single kinds of goods are classed together or in a different manner from on waterways; still it is possible in many cases, and especially on the railways and waterways leading from France into foreign countries, and can be arrived at in great part from trade conditions.

France has a lively commercial traffic with Belgium and Germany, which is handled by 10 waterways and an equal number of railways. The waterways are several decades older than the railways, and the population was thoroughly accustomed to them before the railways came into use. The total commercial traffic between these three countries in 1904 was 14.8 million tons. (The traffic in the same year on the Ferdinand's Northern Railroad was about the same and would compare favorably with it.)

Of these 14.8 million tons of French traffic 4.1 million tons were carried on the waterways and the rest on the railroads.

The combined traffic in raw products and cheap bulk freights, such as building material, fertilizers, hard coal, building stone, slag, ore, marble, etc., between France and Belgium amounted to 9.3 million tons, of which 3.2 millions, or 34.6 per cent fell to the waterways and the remaining 65.4 per cent to the railroads.

On the Rhone-Rhine and the Marne-Rhine Canals, which have connected France with Germany for 70 years, the traffic in raw productions and cheap heavy freights amounted altogether to 356,582 tons. According to business statistics the total traffic in these goods was only about 4,000,000 tons, so that 21 per cent of bulk goods fell to the canals and 79 per cent to the railroads.

In regard to the principal article of transport, namely, coal, which can be carried directly from the mines on the many hundreds of kilometers of waterways which connect France with Belgium and Germany, the French statistics of commerce and traffic show that of 7.6 million tons of imported coal only 2.4 million tons—that is, 31.5 per cent—are carried on the canals, the rest coming by rail.

Neither in inland traffic of cheap bulk freight does a preponderating amount go to the widely-ramifying waterways of France. Of the total 48.5 million tons of coal trade 38.5 millions were carried on the railroads and only 10,000,000 on the waterways, although a large share of the industries of France were settled on the waterways before the existence of railroads. Later industries naturally preferred the newly established railroads, but with us we seem to expect that industries will prefer to settle on the Danube-Oder Canal, and that

the great industries which are looked for in Galicia will settle only on the Oder-Weichsel Canal.

Seven and one-half million tons of fertilizers and fertilizing material—articles of the least value—were carried on the French railroads, and only 1.4 million tons, or 15 per cent on the waterways. Austria would be a wonderful country if here the very reverse should be the case.

The French business world knows how to value the superiority of the quick, easier, and more certain railway transportation and willingly pays the somewhat higher rate.

It is not likely that the Austrian business world would be very different, even though visionary individuals might make occasional experiments.

The immense size of the proposed boats for the Danube-Oder-Weichsel Canal—600 tons burden, as against those used on the French canals—300 tons—would make conditions even worse, for, as already mentioned, who could use 60 carloads of stone, sand, brick—yes, even of coal—at one time?

Many similar examples could be presented but these from France, the land where canal navigation has been carried on for so many hundred years, must suffice.

If artificial waterways really were superior to railways for traffic, and if they were especially effective in promoting agriculture, it would surely be apparent in France—that classic land of waterways—by a noticeable increase in traffic on her canals, as commerce and traffic in France have taken great strides forward during the past 10 years. This, however, is not the case. For example, during the decade from 1896 to 1905, the railroads took half as much again of the total traffic as the waterways, although there were no tolls on the latter and the freight rates were much less than on the railroads. During this period the traffic on the French natural and artificial waterways amounted to only 894,000,000 ton-kilometers, that is, 21.3 per cent, or an average of 2.13 per cent per year, against 4,100,000,000 ton-kilometers, that is, 32.8 per cent, or an average of 3.28 per cent per year on the railroads. From that it can be seen that the general traffic turns more to the railroads than to the waterways.

Of the total 4,850 kilometers of French navigable canals, only 21 per cent have a circulation of more than 1,000,000 tons, 14 per cent of from one-half to one million tons, 36 per cent of 100,000 tons to 500,000 tons, and 30 per cent less than 100,000 tons.

It is not likely that traffic conditions on the Danube-Oder-Weichsel Canal would be so much more favorable as to make these figures even halfway correct.

The yearly increase of traffic, even on the French waterways, is so small that, considering the backwardness of industry and agriculture in Moravia, Silesia, and Galicia, one can see that there will be no traffic worth mentioning on the Austrian canals for many years to come.

The yearly increase of traffic, even on the French waterways, is so kilometers of the St. Quentin Canal, the most important canal in France for the transportation of coal, and in use on its full length ever since 1810, amounts to only 641,000 tons, or an average of 64,100 tons per year; on the 34 kilometers of the equally busy Oise lateral canal, an important line of transit, only 848,000 tons, or an average of 84,800 tons per year; on the Aisne Canal, 44 kilometers long,

opened in 1840 in the highly developed industrial department of the same name, with many manufactories and an annual consumption of 800,000 tons of coal, 40,700 tons. And right here let me say that during this same period the production of coal in France, which should naturally have fallen to the canals, increased about 6,000,000 tons, iron ore about 3,300,000 tons, and pig iron about 1,000,000 tons.

Other old French canals even show a decrease in traffic. For instance, the Burgundy Canal, 242 kilometers long, in use since 1832, showed a decrease of 45,000 tons; the Berry Canal, 142 kilometers, opened in 1839, 25,000 tons decrease, etc.

The expectation of the canal enthusiasts in Austria that the Danube-Oder-Weichsel Canal will cause an immense increase in trade, that even at the first there will be a very large traffic and after a few years a circulation of 5,000,000 tons, that it will, moreover, according to the "certain conviction" of a member of Parliament, pay an interest of from 4 to 7 per cent, will be followed by bitter disappointment to the already heavily burdened taxpayers.

### PRODUCTION OF FRANCE AND OF MORAVIAN SILESIA.

Because of the importance of the subject it is necessary to call attention to some facts which are shown from a comparison of those with French provinces which have the greatest number of industries, the largest amount of production, the densest population, and the largest water traffic with the Austrian provinces of lower Austria, Moravia, Silesia, and the western part of Galicia as far as Krakau, through which the proposed Danube-Oder-Weichsel Canal would pass.

Of these French provinces the principal are the six lying in the north of France, namely, Aisne, Du Nord, Pas de Calais, Oise, Seine, and Somme, which altogether are about 20,000 kilometers smaller in extent than the four Austrian provinces taken. Therefore no one can raise the objection that the comparison is too favorable to France as to extent of area given.

| | Six French provinces. | Austrian districts. |
|---|---|---|
| Total area (square kilometers) | 32,568 | 52,193 |
| Number of inhabitants (in millions) | 8.2 | 6.7 |
| Density of population; that is, number of inhabitants per square kilometer | 252 | 128 |
| Number kilometers of natural and artificial waterways | 1,393 | ..... |
| Proposed navigable canal | ..... | 400 |
| Length in meters of railroads per square kilometer of area | 136.8 | 98 |
| Coal production in | | |
| Du Nord (million tons) 6.2 | | |
| Pas de Calais (million tons) 17.2 | | |
| Total | 23.4 | ..... |
| (That is nearly two-thirds of the total output of coal in France. In 1880 it was only 19.4 million tons.) | | |
| In Moravia (million tons) 1.7 | | |
| In Silesia (million tons) 5.2 | | |
| In Westphalia (million tons) 1.1 | | |
| Total | ..... | 8.0 |
| (That is one-third of the French output.) | | |
| Amount used for industries and trade in year (in million tons) | 16.6 | (1) |
| The number of manufactories altogether | 14,200 | ..... |
| Number of boilers in factories | 25,400 | ..... |
| Production of beet roots in 1905–6 (tons) | 800,000 | 291,000 |
| Number beet-sugar factories | 239 | 65 |
| Number of boilers | ..... | 606 |
| Number of steam engines | 2,240 | 1,149 |
| Amount of horsepower | 65,000 | 29,418 |
| Amount of coal used in sugar factories (million tons) | 0.8 | ..... |
| Beet roots used (million tons) | 6.8 | 2.1 |

[1] In Austria unknown.

The industries, production of raw and manufactured articles, and agricultural products of the French district are from two to three times greater than those of the Austrian district, and the most important of them are given in the foregoing table.

These figures as to industry and production are taken from the Annual Statistics of France (Annuaire Statistique), 1906, and from the Handbook of Austrian Statistics (Handbuch der Oesterreichischen Statistisk), 1906, also in part from the statistics of the Austrian department of agriculture.

The production of coal and sugar and beet roots in the six French provinces is nearly three times as great as in the Austrian district chosen. The manufacturing and agricultural activities show similar conditions.

The Department du Nord alone has 328 inhabitants to the square kilometer, and belongs to the most thickly populated district of Europe, being surpassed only by the Rhineland and Westphalian districts, with their 29,000 square kilometers, and their 10,000,000 inhabitants—that is, 346 inhabitants to the square kilometer.

In the Department du Nord there are 6,900 engines of 403,000 horsepower—nearly one-fifth of all in France. Such concentrated industry and production as exists here naturally leads to a great use of all means of transportation, many stretches of road having a circulation of 200,000 tons. The density of population is naturally closely related to the amount of trade and traffic. If the waterways would have a large traffic they must be supported by a far-reaching network of roads and railroads.

In order to have the same amount of railway as north France, the Austrian district mentioned must add 3,400 kilometers of railroads to her system, at an outlay of about 400,000,000 crowns—which, however, would be of immense benefit to the whole population; whereas the canal, which would be nearly as expensive, would benefit only a few industries and wholesale concerns.

One can affirm with certainty, therefore, that the Danube-Oder-Weichsel Canal will not within a reasonable time attain even a third of the traffic of those waterways of France which run from Paris for a distance of 284 kilometers toward the north and the Belgian frontier, and into the great Belgian coal fields, touching all these provinces and having a circulation of 3,846,347 tons.

Notwithstanding all these favorable circumstances, however, the traffic on these French waterways—the most important of all as far as length and traffic are concerned and which includes the St. Quentin Canal—increased only about 1,431,000 tons in 18 years; that is, from 2,415,000 tons in 1887 to 3,846,347 tons in 1905, or an average of 79,500 tons per year.

Of the remaining waterways in these provinces, having a total length of 1,393 kilometers, of which 856 kilometers are canals, only five, with a combined length of 202 kilometers, have attained a circulation of from four to five million tons within a period of from 70 to 100 years.

These are mostly short connecting reaches of a ramifying network of waterways, among which one (St. Quentin) had 95 per cent.

Other specially favorable conditions affecting the waterways of these provinces are (1) that they are connected with the North Sea

and with the Atlantic Ocean, where many large seaports lie, such as Dunkirk, Havre, Calais, Boulogne, etc.; (2) that the climate is greatly moderated by the nearness of the sea and the traffic of the waterways, therefore, is only slightly interrupted by ice in the winter; and (3) because of the proximity of Belgium, one of the oldest and wealthiest of the civilized countries of Europe.

Such unusual conditions of production, consumption, and trade, such favorable geographical and political conditions as are found in these six French provinces are seldom encountered—certainly not in Moravia, Silesia, and Galicia—and yet even in France, with her 12,070 kilometers of waterways, only 202 kilometers show a traffic such as is expected within a few years on the 400 kilometers of the Danube-Oder Canal. Strong faith and a vivid imagination are necessary in order to place any credence in such expectations.

If our wretched political and national conditions do not improve very soon, or are not changed for the better by an iron hand as they were in France 300 years ago, we shall never, in any case, attain such a state of culture as is enjoyed now in northern France.

### CLASSIFICATION OF FRENCH WATERWAYS.

In the bill of August 5, 1879, all the natural and artificial waterways of France were divided into 20 different lines or groups, the most important of which shall be quoted in order to show that even in France, on long distances, the immense traffic that we expect on our proposed canal is not forthcoming.

The most important line, which carries coal from the two largest coal districts of France, du Nord and Pas de Calais, and also a large part of the coal and coke imported from Belgium, is the one already mentioned, 284 kilometers long, leading from Paris to the Belgian frontier near Mons, the principal seat of coal production, with a circulation of 3,846,347 tons.

The second largest waterway leads from the Scheldt to the North Sea; it is 221 kilometers long and had in 1905 a circulation of 1.9 million tons, though even in 1887 it had 1.2 millions.

The third largest is from Paris to the eastern frontier, a line 494 kilometers long, with a traffic of 1,000,000 tons, which in 1887 was 0.5 million.

A fourth, the canal which connects the former with the Northern Railroad, has 1.7 millions tons traffic.

All the other 16 large waterways have a traffic of much under 1,000,000 tons, although many of them have been in use for over 100 years. For instance, the celebrated canal from Berry, opened in 1840, having with its branches a total length of 323 kilometers, has only 217,000 tons traffic, and the long waterway of 607 kilometers which connects the Atlantic Ocean with the Mediterranean, together with the Canal du Midi, also one of the oldest and also largest of the French canals, had a traffic of 186,000 tons in 1905, and of 81,600 tons in 1887.

From these instances it can be seen that the assertion of those in favor of canals that artificial waterways tend to promote the establishment of new industries is not true, as the two or three hundred years during which these two canals have been in use is quite enough to have shown it forth.

On the other hand, the oldest canal in France, the celebrated Briare Canal, opened in 1642, having a length of 107 kilometers, has a circulation of 940,000 tons.

Another of the most important canals in France is the Canal de l'Est, on the boundary between France and Germany, which was begun after 1870, more from patriotic than economic reasons, and finished in 1882. In 1887 this canal had a traffic of 416,000 tons and in 1905 only 1.1 million tons, although it runs through Provinces having large industries and much trade and serves the imported coal trade from Belgium.

This canal was one of the most easily built imaginable, nevertheless the cost of its construction was 92,000 francs per kilometer more than the estimated cost, or nearly one-third as much again. The total cost ran up to 280,000 francs per kilometer.

The longest French waterway, 1,354 kilometers (and the most enthusiastic canal lover could not ask for more), is the one running through the middle of France from the canal La Manche to the Mediterranean Sea—that is equal to the distance from the Baltic to Triest—which showed a traffic of 926,000 tons in 1905 and 556,000 tons in 1887, an increase, therefore, of 370,000 tons in 18 years, or a yearly average of 20,000 tons. That is pitifully little.

The canal men say that the dimensions of the French canals are too small, and that large canals, accommodating boats of 600 tons or more, would attract more traffic. The inconsistency of this statement has been proven from the Canal du Midi, already mentioned, as this canal is one of those built under Louis XIV in the middle of the seventeenth century, and has the largest dimensions of any of the French canals, i. e., 6 meters breadth of locks; and is, moreover, blessed with a mild climate and runs through Provinces having a highly developed state of agriculture.

There are many similar examples. Nevertheless we expect the Danube-Oder Canal to be an exception and to cause a prodigious industrial development. A member of Parliament speaks of this expectation in the following manner:

> The arousing of industry in West Galicia will only be possible through the building of a Danube-Oder Canal; through it the rich natural treasures of the country will be disclosed; the spirit of enterprise will be aroused. It behooves us to raise the standard of culture and the power of consumption of 9,000,000 people.
>
> Hundreds of thousands of tons of petroleum, spirits, and cereals will stream from Galicia for transportation on the canal; iron ore from Steiermark and Bosnia will be freighted to the north, etc.

With such high-flower phrases, which are in reality only big-winded business politics, is the public hypnotized and made to endanger its own business and financial future. It would be much better for Galicia to merely strive in a rational manner to increase her agricultural productions, the cultivation of the land and the raising of cattle, rather than to juggle with industries from purely nationalistic motives at the expense of the State.

## GERMAN CANALS.

In regard to the German canals, which are also highly instructive, we have already discussed the unusually favorable conditions which have made their construction, especially in North Germany, both easy

and justifiable. We will, therefore, consider merely their business and financial results, although no such complete and comprehensive facts concerning them can be procured as from the French canals, as German statistics of traffic do not contain such detailed facts, and there is no official statement to be had. The condition of and receipts from traffic therefore must be gathered from those technical German periodicals which have to do with that particular branch of trade and which furnish the official information desired.

It is evident that in this case, as with all statistical comparisons, mathematical accuracy is impossible, but as clear an idea as possible will be given.

First of all, as regards our neighboring Province, Bavaria. Here also there has been much agitation for many years over the construction of large waterways, which stand in a certain reciprocal relation to the efforts being made in this country, as even the slightest success in the one will be pointed to with satisfaction by the canal enthusiasts in the other.

Bavaria, however, having had every opportunity to learn wisdom from the unfortunate experiences with the Ludwig Canal, should approach this new undertaking with caution.

The Ludwig Canal makes use of the Regnitz and the Altmühl (which has been rendered navigable) and was built by a joint stock company for the astonishingly small amount of 28,000,000 marks per kilometer, and was taken over by the Bavarian Government in 1852. This canal is 11 meters wide at the bottom with a depth of 16 meters, and accommodates boats of 120 tons burden—equal to 12 carloads.

The traffic on this canal decreases year by year in proportion to the growth of the network of railways. The canal has a yearly deficit, besides being unable to pay interest, and is a heavy burden to the Bavarian treasury—so much so that the minister of finance of Bavaria once declared in the committee on finance of the upper chamber that "it would really be better to give up the canal and rent the land for pastures."

Every ton carried during the past 56 years has brought the State an average of 1½ marks from freight rates, but has cost it about 10 marks, so that it has paid out more than five times as much as it has received on every ton of freight carried. The largest amount of freight carried was 180,000 tons, despite the many industrial cities through which the canal passes—Bamberg, Fürth, Nuremberg, etc.

The yearly allowance of the State for maintenance is from 70,000 to 80,000 kronen, and the total cost to the Bavarian Government up to the present time is about 80,000,000 marks; that is, more than double the amount of the original capital invested.

If it is assumed that the traffic on the Danube-Oder Canal will be greater than that on the Ludwig Canal, so, on the other hand, will the cost of construction be five times as great, and naturally the cost of maintenance would be considerably greater. Therefore it is safe to prophesy that the financial results will in the end be even worse for the State and for the taxpayer than those of the Bavarian canal.

Here also the canal advocates, in order to account for its lack of success, try to show that the dimensions of the canal are too small. They say that with larger dimensions for canal and boats the traffic, in their opinion, would be larger also—a conclusion which the facts already related in regard to French canals have proved false.

One of the largest and most important canals in Prussia is the Dortmund-Ems Canal. It has about the same dimensions as those contemplated for the Danube-Oder Canal, except that the latter has a greater depth of water, which naturally increases the cost. The Dortmund-Ems Canal connects the largest coal district of the Continent, the Ruhr district, with the North Sea and should check the increasing importations of English coal into German ports. Twenty-two coal mines lie along its course, with a yearly output of 12,000,000 tons of coal. That is about 4,000,000 more than the combined coal districts of Moravia, Silesia, and Galicia and 5,000,000 more than the Kaiser Ferdinand's Northern road carried of domestic and foreign coal in 1906. From 22,000 to 23.000 cars are put aside by the Prussian State Railroad daily for loading in the Ruhr district.

In order fully to comprehend the magnitude of this amount, it should be remembered that the Northern Road has only one car yard of 130,000 coal and coke cars for all its lines together; that in Vienna the number of cars used in the daily traffic—according to a pamphlet which appeared last year with reference to a Central Railway station for Vienna—is only 8,000 cars of different kinds; and further, that at Brüx, the principal station for the soft coal trade on the Elbe, 2,000 10-ton coal cars are loaded daily.

There is probably no other region that has so concentrated an output in so small a space as the Ruhr district. It has only 3,648 square kilometers with 2.9 million inhabitants and has 1,302 kilometers of railroads; that is nearly as many as the total system of the Ferdinand's Northern Railroad.

At first glance, perhaps, these figures do not seem particularly remarkable, but they arouse surprise if one compares them and finds that in the Ruhr district there are 806 inhabitants to the square kilometer—nearly eight times as many as in the other parts of Germany. There are 357 meters of railroads to the square kilometer in the Ruhr district, or three and one-half times more than in the rest of Germany. To 1 kilometer of railroad in the Ruhr district there are carried 82,795 tons of freight; on our Northern Road, of nearly the same length, there are only 14,221 tons, or about one-sixth. In the whole of Europe there are only five (English) roads, with a total length of 418 kilometers, that have a heavier traffic in coal.

In the Ruhr district the number of tons of freight transportation per person is 36.6 tons; in the rest of Germany 7.5 tons; and in the region of the Austrian Northern Railroad 3.1 tons.

Notwithstanding this gigantic traffic in the Ruhr district the Dortmund-Ems Canal has not come up to expectations; nevertheless these same expectations are looked for with certainty on the Danube-Oder Canal, which runs through a territory with a much smaller trade.

In the Government statement of railroads given out by the Prussian Department of Government Works the cost of maintenance and operation of the Dortmund-Ems Canal for three years is put down as 1,011.689 marks; the revenue from tolls, etc., at 138,376 marks; and the total interest on capital as a disbursement of 3,275,316 marks; and further, that the 19 other artificial waterways of Prussia—canals and canalized rivers—with a total length of 2,485 kilometers, showed a deficit of 1,088,916 marks, or, including the interest, 9,599,076 marks. The total capital invested in the same amounted to 243,000,000 marks,

or 97,919 marks per kilometer. At the end of this report it said, "From this statement it can be seen that the financial results of the Prussian waterways are, in general, far from satisfactory."

According to a report presented to the Prussian Parliament in 1907, the Dortmund-Ems Canal, with the most favorable conditions imaginable for traffic, such as could never be expected on the Danube-Oder Canal, or at least not for many decades, has, after nine years of business, attained a traffic of only 1,700,000 tons, or only one-third of the traffic expected. It was calculated that certainly 2,000,000 tons of hard coal would be shipped yearly from the Ruhr district to the sea and that the importation of English coal would decrease.

In the discussion over the bill in the Prussian Parliament, however, the warning was given not to pin their faith too closely to this expectation, and the warning has proved prophetic, for the entire traffic on the canal, as has already been said, is only 1,700,000 tons, of which only 40 per cent, or 680,000 tons, were coal; and the importation of English coal into the large German seaports has not been checked; on the contrary, it has increased from 1901 to 1906 from 5.2 million tons, valued at 78.1 million marks, to 7.6 million tons, valued at 104 million marks.

Those in favor of canals either do not mention the unfavorable financial results of the Prussian waterways, or else comfort themselves by saying that "these unfortunate consequences are quite easily explained, as the canal is too short and should be continued and branch canals built." "As soon as the connections with the Rhine and the Elbe and the Weser are built the traffic on this intermediary canal will greatly increase." And so in order to realize this hope the Prussian Government would grant 197,000,000 marks for the construction of 341 kilometers of new waterways.

In North Germany, however, the flat, level country is at least auspicious for such construction, while with us it is very far from being the case.

The peculiar conditions in North Germany entirely justify the construction of waterways there, on the grounds already frequently mentioned. Any generalization of such business conditions, however, would lead to error.

The cost of this new proposed canal, already partially undertaken, is placed at an average of 577,000 marks per kilometer. Single portions, for instance, of the Rhine-Herne Canal would cost as much as 1,365,000 marks; the two ship branch canals, 812,000 marks; and the main canal of 174 kilometers, from Bevergern to Hanover, containing no locks, 480,000 marks, per kilometer.

### CONCLUSIONS FROM THE GERMAN CANALS.

According to these facts it would be an inexcusable risk to build the Danube-Oder Canal; and it would be a crime on the Austrian treasury to expend millions in constructing a canal from Oderberg to Krakau in order to arouse industry in Galicia, through a district where the second line of the Northern Road was built only two years ago (for strategical reasons, not for traffic) and where the railroad traffic, as compared to that of the main line from Oderberg to Vienna, is exceedingly small.

We can foresee from the following figures on taxes who will be the one to come forward in order to meet the inevitable deficit which will arise from this miscalculation.

According to Austrian statistics for 1906 (p. 377), the prescribed revenue tax per each inhabitant was: 8.51 kronen in lower Austria; 1.77 kronen in upper Austria; 2.36 kronen in Salzburg; 1.99 kronen in Steiermark; 1.62 kronen in Kärnten; 1.51 kronen in Tyrol; 2.07 kronen in Voralberg; 1.80 kronen in Bohemia; 1.69 kronen in Moravia; 1.68 kronen in Silesia; 0.98 kronen in Bukowina; in Dalmatia only 0.58 kronen—the lowest of all; and in Galicia 0.63 kronen, the second lowest. The average tax in Austria amounted to 2.24 kronen per head.

With the other taxes and assessments it is much the same. It is well known that Vienna pays one-fifth of all the Government's expenses, and it is all the more incomprehensible that members of Parliament from Vienna should be so eager for such a risky undertaking and one which will burden their city with many more million crowns in taxes. If the loss reaches too high a figure the city council will place its veto on it, as it did recently with the Vienna city road. Then, however, it will be too late—a fateful word often heard in Austria. An old minister of finance tells how once at a meeting of ministers before the Emperor he said, "Shall lower Austria, then, allow the entire Kingdom to feed on its breast and suck its fill?" This fear can easily become a fact.

### THE SACREDNESS OF WATERWAY BILLS.

And then there are some members of Parliament who think that it is now too late to talk about the revenue to be collected; the canal must be built whether it will pay for itself or not; the waterway bill has been sanctioned and therefore it is sacred.

If only the sacredness of laws were always so considered! But where a law does not happen to suit certain members it is not looked upon as sacred. If, however, members of Parliament take these statutes so earnestly, it is their first duty to see that all bad ones—and there are enough of them—are repealed as soon as possible. Hundreds of laws which are no longer in keeping with the times, or have been outrun by events, have been changed. For instance, the laws in regard to school and business have been remade. Innumerable important treaties, especially treaties of perpetual peace between countries, have been put aside; and there would be no difficulty in repealing or changing fundamentally a hastily and injudiciously made statute in regard to waterways—a statute which could only work harm to the financial condition of the State.

### OPINIONS OF FOREIGN SCIENTIFIC JOURNALS.

One sentence in the Journal (*Archiv*) already mentioned, and which can be fully relied upon, shows how it stands with the old German waterways, whose immense traffic is pointed out with satisfaction by canal men.

In December, 1905, it says:

> It would be unjust to place the burden of expense for the construction and improvement of waterways on the general public, or as the saying is, on the mass of poor folk.

While the Prussian State railroads are expending more than 400,000,000 marks over and above the interest on and liquidation of capital, for the general benefit of the provinces, the Prussian waterways are demanding at the same time a yearly allowance of 27,500,000 from the public treasury. The waterways benefit directly only a small circle of people; they should not be increased further.

Just as the economically strong are able to shift the burden of taxation on to the economically weak, so on the other hand do they understand how to hold fast all advantages which turn their way. Even in the case of the Ruhr coal, four and one-half times as much is transported by rail as by water. A real lowering in the cost to the consumer is only to be attained by a reduction in railroad rates.

The revenue collected for general Government purposes should not be applied to rivers and canals; only such as is raised by the provinces through taxes for their maintenance, operation, interest, and liquidation of capital should be considered.

And in another place it says:

> France not only built, but redeemed most of her far-reaching interests of waterways before the time of railroads. As it is well known, through technical observations, that the passenger traffic on the Prussian railroads only covers the cost of operation, the surplus expense should be distributed on the 400,000,000 tons of freight traffic at 27,000,000 ton-kilometers.

On page 1284 it goes on to say:

> Who is in a position to take 600 tons of coal, fertilizers, or grain at one shipment? But partial ship loads do not pay, as a large boat can only make itself pay if used to its full capacity. The larger the boats, the smaller the number of people directly benefited.

Sympher, the foremost German waterway specialist, the apostle, so to speak, of all canal enthusiasts, whose word is authority in all that pertains to waterways, says in regard to the new artificial waterway in contemplation, that—

> The high plains of north Germany possess in an unusual degree everything necessary for the establishment of a cheap and adequate artificial waterway. Low watersheds separate most of the streams running north and south, the waters of which furnish a plentiful source of supply for the canals, etc.

Another instructive example of the condition of German waterways is the canalized Main, to which all who are in favor of waterways point with satisfaction. In its first year it had a total traffic of 396,000 tons; in its seventeenth year it had only increased to 2,365,000 tons, and that merely because Prussia turned over the canal tolls to the city of Frankfort.

The Oder-Spree Canal, one of the most important of Prussian waterways, carried in its first year 637,000 tons; in its thirteenth year, only 2,416,000 tons. The Märkischen waterways amount altogether to 1,154 kilometers of regulated and canalized rivers and canals and represent an investment of 90.3 million marks, only about one-tenth of the cost of the Danube-Oder Canal, the interest on which at 3 per cent and the liquidation of capital at one half of 1 per cent would require a net income of 3.2 million marks.

The disbursement for maintenance, etc., of this great waterway system amounted in 1905 to 1.9 million marks; the income from navigation tolls, etc., was 3.9 million marks. There remained, therefore, a surplus of 2,000,000 marks, which was not sufficient, however, to

cover interest and liquidation, as there was a deficit of 1.2 million marks.

The net income of these mighty and far-reaching waterways, so rich in traffic, only suffice to pay an interest of 2.61 per cent on the Berlin waterways proper, and 2.13 per cent on the remainder of the Märkischen waterways.

The Teltow Canal, 40 kilometers long, which was recently constructed by the District of Teltow without the assistance of the Government, in order to shorten the Berlin waterway, is often pointed to as an instance of the wisdom of the Prussians. This canal, as already shown, owes its construction primarily to its usefulness as a drainage canal.

As to its financial results the Journal of Inland Navigation (Zeitschrift für Binnenschiffahrt), a paper devoted to furthering the interests of German waterways, says in 1908:

> The Teltow Canal cost 39.2 million marks. That it should already pay interest is asking too much. Posterity only will reap the full benefit to be gained from it.

M. Peters, of the department of public works, made the following observations in a paper last year in the report of the Society for Social Politics (Verein für Sozialpolitik), a paper well worth our consideration:

> The common business principle of taxation is only just when all taxpayers of the State have an equal interest and derive the same benefit from an undertaking, which in the case of transportation facilities extending over only a portion of the country is not so. That the deficit in income from such Government undertakings is counterbalanced by the increase of the general welfare and taxable strength of the taxpayer is false. The theory that the cost of improvement of rivers, canals, and harbors is compensated by the increase of tax power has not received adequate confirmation.

With us, so far, the many Government undertakings have only led to heavy debts for the State to carry.

### VIENNA-WIENER-NEUSTADT CANAL.

Austria did have one canal, built toward the end of the eighteenth century, from Vienna to Wiener-Neustadt, which, in spite of its small dimensions, copied after the French canals, did show in the twenties of the last century a comparatively large traffic. After the opening of the Southern Road—especially since the Northern Road brought far better coal to Vienna than could be found in the Wiener-Neustadt district—the traffic on this canal gradually decreased until in the seventies the canal was abandoned, and has since served only as a place for cutting ice and to supply water for certain manufactories.

Here also the canal men, who do not in any case care to be reminded of the fate of this canal, feel that the dimensions were too small for a large navigable way, but they are of the opinion, nevertheless, that it might have preserved its importance as a way for transportation.

### LIVERPOOL-MANCHESTER CANAL.

Another example of great expectations from the construction of a large ship canal, given in this same Archiv on railroads for the year 1903, is the great canal, 57 kilometers long, built between

1887–1894 for 360,000,000 kronen, to connect the two greatest industrial and commercial cities of England—Liverpool and Manchester.

The report says:

> The small results during the first 10 years after the opening of this canal was because of the adherence of trade to the customary railroads. An article in the Manchester Guardian calls this adherence the natural conservatism of business.

The entire wool trade was carried on in Liverpool after just the same as before the building of the canal, the light in Liverpool being better for wool inspection than the light—or rather twilight—of Manchester.

Nevertheless, according to some writers, the benefits from the canal to city and district of Manchester is shown in larger receipts of letters and packages, an increase in the consumption of gas, a renewed rental of vacant houses, and an increase in the taxable strength of Manchester and Salford. The city of Manchester gave £5,000,000 for the canal, and because of the great loss of interest landed proprietors must pay a higher tax on land, which, however, they immediately add to the rent of their fields.

The canal has contributed largely to the upbuilding of the city by developing a number of industries and different branches of trade, but these happy results must not be overestimated. The canal has caused a considerable abatement in the rates on privately owned railroads; this, however, reacts disadvantageously on the canal. As to any actual benefit to the public—to the consumer, for instance—in a reduced price on goods because of cheaper transportation, nothing is reported.

In another place it says:

> The canal has not made good its business promises. It has taken only an insignificant portion of the mighty stream of goods pouring in upon us, and has not, certainly, fulfilled the business need, as its promoters promised it would.

That is a moderate, though disappointing, statement of the fulfillment of all the hopes and plans of our canal friends.

According to this report the net receipts give an interest of only 1.8 per cent after 13 years of business, and the latest reports show about the same conditions. In England there are no Government railroads, the entire business of transportation being in the hands of private companies.

If therefore the stockholders in this canal lose, or in any way fail to meet their obligations, the taxpayer need not in the least worry—except the citizens of Manchester, who, because of the financial participation of the community, would be brought directly into such misfortune through increased taxes due to the loss of interest.

The great national wealth of England, however, could stand any such loss much better than heavily indebted Austria.

The Liverpool-Manchester Canal has, however, on its side, made a great show, and has led a large number of waterway men to the foolish idea of turning all large important inland cities into seaports. Vienna, say they, should be connected by a great sea-level canal with Trieste. Such a canal, however, would be synonymous to a tunnel, 400 kilometers long, navigable for all seagoing vessels, and would also give to Vienna the often promised protection against further damage from floods by turning off the overflow of the Danube during high water.

ENGLISH AND AMERICAN CANALS.

In England there were many thousands of kilometers of inland canals before the time of railroads. They have now, however, in large part, been completely abandoned, as they do not come up to the Englishman's inborn love of speedy transportation. A few of the old canals are used for local traffic. The ultimate fate of the English canals was marvelously foretold fully 80 years ago, at the very beginning of railroads. A member of a commission sent to England by the Prussian Government to study the English street-car system—to which concessions of thousands of kilometers were being made—and the earliest English steam railroads, made the following observations in his report:

> Because of the tremendous speed of the steam roads (at that time 25 kilometers per hour) canals and railroads (meaning horse railroads) can no longer compete with them. There are at present 80 canals in Great Britain, many of which are widely separated, and the investment in which still calls for interest, while the stock on more than 40 of them is not worth more than half or even less.

According to a statement in the "Zentral-Blatt der Bauverwaltung," published by the department of public works in Prussia, there were 4,060 kilometers of navigable canals and 661 kilometers of canalized rivers still in use in the United States in 1880, most of which were built between 1817 and 1848, at an average of 151,250 marks per kilometer; that is, about one-sixth of the price computed for the Danube-Oder Canal.

Most of these canals are in the States of Pennsylvania and New York. Pennsylvania has the greatest coal fields in the world, and, according to the American statistics for 1906, an output of 170,000,000 tons of anthracite and soft coal—that is, more than half of the total production of coal in the Union—in all, about 338,000,000 tons, worth about 2,400,000,000 crowns in the market.

In spite of this gigantic trade in coal only the comparatively small amount of 21,000,000 tons falls to the canals for transportation, although they run directly through the coal district, whereas the railroads have transported by far the larger portion.

The canals and natural waterways could not, however, compete with the constantly increasing railroads, and by 1883 some 3,138 kilometers of waterways were abandoned after having been in use for from 20 to 50 years.

Since then, as the Railway Gazette informs us, several canals which formerly had a heavy traffic have also been abandoned; as, for instance, the Delaware & Hudson Coal Co.'s canal, 174 kilometers long, which was built for 153,450 marks per kilometer. It is to be closed and a railway built in its place. Then the Chesapeake & Ohio Canal went into bankruptcy because it could not pay interest.

The Pennsylvania Coal Canal, 588 kilometers long, one of the oldest and most used canals in the country, had in 1893 a deficit of 237,800 kronen for operation, together with a former debt for interest of 685,275 kronen, besides other debts amounting to 707,940 kronen. At a meeting of the stockholders on April 11, 1901, it was decided to abandon the canal, and the land is now for sale. A part of this canal was given up some years earlier.

The long time taken for transportation is what has worked harm to the canals, rather than cheap railway tariff.

There is a great contrast between America and Austria. In America, in the greatest coal fields in the world, where coal can be taken out even by daylight workings, they are abandoning old, well-established canals; whereas in Austria—i. e., Galicia—they are proposing a million-crown canal for coal not yet discovered, at least not yet opened up, and still lying deep in the bowels of the earth.

The Erie Canal, together with certain supplementary extensions, built by the State of New York at a total expense of 330,000,000 marks, and first opened in 1825, and which with its branches has a length of 766 kilometers, is the only one which has not met the fate of most of the American canals, although in 1880 it came very near to being abandoned.

Then, as canal navigation could no longer compete with the railroads because of the maintenance of canal tolls by the State, thus, says the Railway Gazette, "occurred one of the most backward steps in the history of the United States. The tolls were given up. The State saw itself in a position where it was compelled to keep open a free way to transportation at great expense in order to enable one class to enter into equal competition with other classes. Is it right for a father to turn over the maintenance of his child to another?"

However, matters could not be improved by merely abrogating or reducing the toll. But the influence of former Presidents of the United States has succeeded in preserving this largest of American canals from ruin. It is now being rebuilt for large ships of 1,000 tons burden.

One glance at a map suffices to justify this act, and enables one to comprehend the preeminent importance of this canal, its commercial and economic value, and even the strongest opponents of canals must acknowledge that such extraordinary conditions justify extraordinary measures.

On the border of the English possessions of Canada lie four great lakes, forming a connecting natural waterway of about 1,700 kilometers in length, joined to which is a fifth great lake, Lake Michigan, lying more to the south.

These five great lakes find their natural outlet through the St. Lawrence River to the Atlantic Ocean, and could carry the total commerce of the lakes to the English ports lying on this river and at its mouth. By building the 566 kilometers of the Erie Canal and connecting Lake Erie with the Hudson River a waterway of 2,500 kilometers is formed—equal to about the distance from Trieste to Alexandria—and the great traffic from the rich grain and lumber districts of Canada and the wheat fields of the Far West can be carried directly to the ice-free harbor of New York.

For every American the maintenance of the Erie Canal is a business necessity. It also serves to appease a certain feeling of rivalry against English Canada, which with railroads would be impossible, or only possible in a very roundabout way.

The attempt to capture the great commerce of Canada for New York is a stroke of business policy such as is contemplated in Germany by the building of the Midland Canal, in order to drive out the commerce in English coal from the German ports.

## CHEAP COAL.

A favorite and much-used argument for arousing interest in the construction of large navigable canals is cheap coal rates, which, however, are of very little value to the general public. This can easily be shown, as the number of those interested in the price of coal is very small compared to that of those interested in other articles of consumption; and, again, of this number only a small per cent would be affected by the cost of coal transportation—namely by a reduction in the same.

The increase in the cost of labor through a single contest over wages, a corner of raw material, taxes, social-political laws, etc., all have much more influence on the price.

Strangely enough the highest coal rates prevail in England, the greatest industrial and commercial country of Europe. The maximum coal rate permitted by Parliament on the English roads, and in practice not always used, is two or three times higher than with us, and only on long distances on a few roads are they the same as ours. The rate on some roads is placed according to the distance of carriage, of 30, 50, and 80 kilometers and over; on others again it is the same for all distances, and on the Barry road, for instance, 106 kilometers long, and on the London & Northwestern, 3,135 kilometers long, amount to 5.43 hellers per ton-kilometer for all distances.

On the Great Western, one of the largest English roads, the rate is graded according to distance, and also according to the branch lines used, from 9.3 hellers to 2.17 hellers per ton-kilometer, etc. That certainly seems a complicated system for arriving at railway rates.

With us they are trying to establish a single rate for the whole of the Empire, by placing the railroads in the hands of the Government, which, considering the great difference in the cost of operation and capital, is unjust, and also leaves the principle of cargoes and equal return cargoes unconsidered.

For the great industrial concerns that use yearly thousands of tons of coal, and for wholesale dealers, a slight decrease in the rate on coal transportation means quite a goodly sum, but the ordinary consumer will not profit one penny thereby, because while on the small amounts such as are bought by the average man, there can be no practical reduction even with a considerable decrease in rates unless coins of one-tenth or one-twentieth the value of a penny are first placed in circulation.

As against this is the share, a very considerable one, which the small consumer—and that is more than 90 per cent of the population—feels in any new or increased tax, indirectly levied, to cover the deficit on a Government road.

The representatives from Lower Austria and Vienna should, therefore, guard against entering the dangerous field of rate politics, which would be brought about through the building of a Danube-Oder Canal; for the people are already suffering without this from the increased expense of all the necessaries of life, and if a deficit should occur, lasting for years, in the interest on the canal investment, it would only mean another heavy burden for them to bear.

The price of coal increases from year to year. The railway freight rates, however, are not to blame, for they, on the contrary, are constantly decreasing, but very different causes, which can not now be gone into.

### A FINANCIAL PROPOSITION.

According to the friends of the proposition the Danube-Oder Canal would give a certain profit of from 4 to 7 per cent.

That is not the case, however, with other canals. In order, therefore, to assure a revenue in case of contrary results, and to make good the promises of the canal advocates, a financial proposition is here made, i. e., that all who expect to gain special advantages from the canal should assume the construction of the canal. It would be enough if they merely guaranteed the interest at 4 per cent on the capital needed for building it, and secure this guaranty with their property or life insurance policies; the state building the canal.

It is strange that such a simple financial suggestion has not been brought forward before by those opposed to the canal. Surely in the industrial districts of Moravia and Silesia and in west Galicia, where the "infinitely rich coal fields still lie buried in the earth," 8,000 persons could be found who would assume a guaranty of 2,000 kronen for interest. That would give 16,000 kronen of guaranteed interest and would cover an investment of 400,000,000 kronen at 4 per cent. There could scarcely be a more simple solution of this very difficult problem.

The members of such a company with perfect security could even have a far-reaching influence on the canal rates without being obliged to consider a possible injury to the Northern Railroad.

### CONCLUSIONS.

From the foregoing statements it may safely be concluded that in the coming age of highly developed railroads, the construction of navigable canals is only justified under exceptional and very favorable circumstances; that such canals, however, are in nowise suited to Austrian conditions and would only prove a source of heavy debt to the State—a debt under which it would suffer financially for a long time.

With the many hundred millions which would be expended in the construction of a canal from Vienna to Krakau, so many other much more necessary and useful business undertakings could be carried out, such, for instance, as the building of thousands of kilometers of highroads and railways, innumerable river regulations and river protection, the improving of the land for agricultural purposes, etc., all of which would benefit the entire country and not only a small group of specially interested people—so that in holding fast to the complete carrying out of the waterway bill one would be answerable to the entire population of the country.

VIENNA, *April, 1909.*

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# PARTICIPATION IN THE EXPENSE OF WATERWAY IMPROVEMENTS IN GERMANY BY THE LOCALITIES INTERESTED.

By Mr. E. O. MERCHANT.

Previous to 1894 the expense of constructing or improving waterways in Germany was borne by the state. The parties interested were only required to turn over the territory, free of cost, or the determined value of the same. By the bill of April 17, 1894, providing for the building of the Dortmund-Rhine Canal, a considerably greater participation was contemplated, the interested parties being required to assume a part of the expense of the interest and liquidation of the capital and the cost of care and operation. This tendency has steadily increased. In the bill of 1898, providing for a canal connecting the Rhine and Elbe rivers, the project was to be undertaken only on condition that the interested provinces or other states should guarantee, from their own funds, the payment of any deficiency in the yearly cost of care and operation (as fixed upon by the minister of public works and not covered by the navigation tolls or such like receipts), and also the yearly 3 per cent interest on one-third of the estimated capital of the main canal, and on one-half of the estimated capital of the branch canals, and for the liquidation of this share at one-half per cent per annum. In consideration of the difficulties of the undertaking at first it is intended to postpone the payments toward the liquidation of the debt until the sixteenth year after the completion of the canal.

Such guaranties are best undertaken by the provinces which can raise the money pledged by calling upon the districts or parts of districts, or the communities in these most benefited. The provinces legally have the right to lay such a division of the burden upon the districts, but in the case of communities special authority had to be granted.

The following table shows the share of both the Government and the provinces in the different parts of the undertaking, and the share of the guaranty falling to the different provinces.

| 1 | 3 | Cost of construction. | | | Cost of care, maintenance, and operation. | | |
|---|---|---|---|---|---|---|---|
| Description of canal. | Length. | 4 Total. | 5 Share of the Government. | 6 Share of provinces. | 7 Total. | 8 Share of Government. | 9 Share of provinces. |
| 1. Dortmund-Rhine Canal, Emscher Valley Canal (Laar-Herne) | *Km.* 39.5 | *Marks.* 45,298,000 | *Marks.* 30,198,670 | *Marks.* 15,099,330 | *Marks.* 509,200 | *Marks.* ..... | *Marks.* 509,200 |
| 2. Completion of Dortmund-Ems Canal (locks at Henrichenburg and second lock at Munster) | 1.3 | 4,067,000 | 4,067,000 | ..... | 36,600 | 36,600 | ..... |
| 3. Central Canal (Bevergern to Elbe), with 8 side canals | 413.6 | 191,668,700 | 121,057,220 | 70,611,480 | 1,347,300 | ..... | 1,347,300 |
| 4. Canalizing of the Weser: | | | | | | | |
| *a.* Bremen-Minden [1] | (149.3) | (42,628,000) | ..... | (42,628,000) | ..... | ..... | ..... |
| *b.* Minden-Rinteln | 43.4 | 14,622,000 | 9,748,000 | 4,874,000 | 193,200 | ..... | 193,200 |
| *c.* Rinteln-Hameln | 17.7 | 5,192,000 | 2,564,500 | 2,564,500 | 82,800 | ..... | 82,800 |
| Total | 515.5 | 260,784,700 | 167,683,390 | 93,149,310 | 2,169,100 | 36,600 | 2,132,500 |

| Description of canal. | Interest and payments on cost of construction=3½ per cent of columns 4, 5, and 6. | | | Combined yearly cost (columns 7 and 10). | | |
|---|---|---|---|---|---|---|
| | 10 Total. | 11 Share of Government. | 12 Share of provinces. | 13 (7+10) Total. | 14 (8+11) Government's share. | 15 (9+12) Share of provinces. |
| 1. Dortmund-Rhine Canal, Emscher Valley Canal (Laas-Herne) | *Marks.* 1,535,430 | *Marks.* 1,056,930 | *Marks.* 528,500 | *Marks.* 2,094,630 | *Marks.* 1,056,930 | *Marks.* 100 p. ct. 1,037,700 |
| 2. Completion of Dortmund-Ems Canal (docks at Henrichenburg and second lock at Munster) | 142,300 | 142,300 | ..... | 178,900 | 178,900 | ..... |
| 3. Central Canal (Bevergern to Elbe) with 8 side canals | 6,708,400 | 4,237,000 | 2,471,400 | 8,055,700 | 4,237,000 | 100 p. ct. 3,818,700 |
| 4. Canalizing of the Weser: | | | | | | |
| *a.* Bremen-Minden [1] | ..... | ..... | ..... | ..... | ..... | ..... |
| *b.* Minden-Rinteln | 511,770 | 341,180 | 170,590 | 704,970 | 341,180 | 363,790 |
| *c.* Rinteln-Hameln | 179,520 | 89,760 | 89,760 | 262,320 | 89,760 | 172,560 |
| Total | 9,127,420 | 5,867,170 | 3,260,250 | 11,296,520 | 5,903,770 | 5,392,750 |

| Description of canal. | Yearly share of guaranty to each province. | | | | | | |
|---|---|---|---|---|---|---|---|
| | 16 Rhineland. | 17 Westphalia. | 18 Hanover. | 19 Hesse-Nassau. | 20 Saxony. | 21 Schaumburg-Lippe. | 22 Braunschweig. |
| 1. Dortmund-Rhine Canal, Emscher Valley Canal (Laar-Herne) | *Marks.* 54 p. ct. 560,400 | *Marks.* 46 p. ct. 477,300 | *Marks.* ..... | *Marks.* ..... | *Marks.* ..... | *Marks.* ..... | *Marks.* ..... |
| 2. Completion of Dortmund-Ems Canal (docks at Henrichenburg and second lock at Munster) | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 3. Central Canal (Bevergern to Elbe) with 8 side canals | ..... | 17 p. ct. 649,179 | 50 p. ct. 1,909,350 | 4 p. ct. 152,748 | 18 p. ct. 687,366 | 6 p. ct. 229,122 | 5 p. ct. 190,935 |
| 4. Canalizing of the Weser: | | | | | | | |
| *a.* Bremen-Minden [1] | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| *b.* Minden-Rinteln | ..... | 61,845 | 181,895 | 14,552 | 65,482 | 21,827 | 18,189 |
| *c.* Rinteln-Hameln | ..... | 29,355 | 86,280 | 6,902 | 31,061 | 10,354 | 8,628 |
| Total | 560,400 | 1,217,659 | 2,177,525 | 174,202 | 783,909 | 261,303 | 217,752 |

5,392,750 marks.

[1] Will be paid for by Bremen.

Unfortunately, owing to the failure to reach an agreement among all the parties interested before the date fixed by the bill, the projects were not carried out. The plan adopted in the case of the part of the canal from Bevergern to the Elbe, where the parties concerned were numerous and very different, well illustrates how the burden was to be apportioned. The provinces had agreed among themselves that their share should be determined by the length of the canal in each, as follows:

| | Per cent. |
|---|---|
| Westphalia | 17 |
| Hanover | 50 |
| Hessen-Nassau | 4 |
| Principality of Schaumburg-Lippe | 6 |
| Duchy of Braunschweig | 5 |
| Saxony | 18 |

The new law of 1905 contains, with some modifications and additions, similar provisions. One additional feature of importance is that the state of Bremen, besides undertaking to carry out some works on the Weser at its own expense, is to contribute one-third of the cost of the impounding reservoirs in the Weser basin and of the regulation works below Hameln.

The following conditions are laid down for the new works.[1]

(1) The provinces and corporations are to guarantee the cost of administration, working, and maintenance.

(2) They are to guarantee 3 per cent interest on about one-third of the capital required, with certain alleviations during the first ten years.

(3) They are to guarantee one-half per cent to the sinking fund from the sixteenth year onward; the state undertaking to provide the interest and sinking fund on the remaining two-thirds of the capital.

[1] Report of the Royal Commission, Vol. VI, p. 89–90.

# REGARDING PRACTICABILITY OF STORAGE RESERVOIRS TO PREVENT FLOODS AND TO BENEFIT NAVIGATION ON THE OHIO AND OTHER RIVERS OF THE UNITED STATES.

By Col. W. H. BIXBY, Corps of Engineers, U. S. Army.

[Being a review by Col. W. H. Bixby, Corps of Engineers, U. S. Army, January, 1908, of a discussion presented November, 1907, by M. O. Leighton, Chief Hydrographer, United States Geological Survey, and printed as part of the Inland Waterways Commission Report, 1908, pages 451–490, on "The Relation of Water Conservation to Flood Prevention and to Navigation in the Ohio River."]

1. The article of Mr. Leighton is an exceedingly valuable addition to existing literature on the subject of the possible use of storage reservoirs for preventing floods and benefiting low-water navigation. It gives a great deal of valuable new information not available in former days, and even available at the present date of his report only because of the liberality of Congress in recent years in providing funds for extension of geographic surveys by the United States Geological Survey throughout the United States, and especially in the Eastern States, and for extension of the Weather Bureau service. Mr. Leighton states on the first page of his report that his paper will have served its purpose if it demonstrates that the use of storage reservoirs in the upper tributaries of the great rivers, for the purpose of preventing floods and of maintaining navigable depths in the lower parts of such rivers, has so many features of promise that it would be a grave mistake for anyone to recommend the permanent adoption of a governmental policy which did not recognize the possibilities of such reservoirs and which did not provide for a further and a more minute investigation of the same. Mr. Leighton's position may be stated briefly as follows:

First, that the proper and logical way to control a river is to control its water supply by the use of storage reservoirs, which will store the water during rainfall, thereby preventing floods in the lower river, and which will allow the gradual wastage of the stored water during dry seasons, thereby increasing the navigable depth of the river at its ordinary low-water stages; second, that it is improper and illogical to attempt the control of floods by first allowing the flood waters to enter the lower river and afterwards endeavoring to confine such waters within high and expensive levees, and that it is illogical and disproportionately expensive to attempt to secure extra depth of water during the dry season by dredging or contraction, or by the use of locks and dams, unless storage reservoirs are impracticable; third, that the control of nearly all the rivers of the United States can readily be effected by the construction and use of storage reservoirs; and, fourth, that while the first cost of the storage-reservoir system will be large, such cost can be distributed over a series of years in such

way as to ultimately appear nominal or small compared with the enormous benefit to be derived from the consequent flood prevention and improvement of low-water navigation, and much more so when considering also the benefit from the use of the stored water for water power and for irrigation. Mr. Leighton illustrates his discussion by an application of the storage-reservoir system to the Ohio River basin, claiming or at least implying that it will on that river give better results than the slack-water system now in progress and should be substituted therefor.

2. Mr. Leighton's proposition stated as above (in slightly different language from his own) is, as he admits, a very old one, its discussion having been carried on for more than a hundred years in Europe and Asia, and for about sixty years in the United States. The American engineers who have most prominently taken part in such discussions are Mr. Andrew Ellet, about 1850; Mr. W. Milnor Roberts in 1857; Maj. G. K. Warren, U. S. Engineers, about 1870; Maj. W. E. Merrill, about 1873; Maj. F. U. Farquhar, about 1875; Capt. Charles T. Allen, about 1880–81, and Capt. H. M. Chittenden, in 1898; the discussions of Mr. Ellet, Mr. Roberts, and Major Merrill applying to the Ohio River; those of Majors Warren and Farquhar and Captain Allen applying to the upper Mississippi; and those of Captain Chittenden applying to the upper Missouri.

3. All engineers, both foreign and American, with great unanimity, have apparently agreed that theoretically the storage-reservoir method is the only proper and logical method up to its limits; but the engineering fraternity has been greatly divided, and still is to-day, on the question of the practicability of the reservoir method when considered from a combined legal and financial point of view. As stated by Mr. Leighton, the report of Mr. W. Milnor Roberts in 1857 was against its practical adoption in the United States at that date; and, while some of his reasons are no longer as valid as when first enunciated, his final conclusion, so far as concerns the United States, has been generally upheld by civilian engineers, army engineers, and by the United States Congress. In Mr. Roberts's original report of April 21, 1870 (p. 6, H. Doc. No. 72, 41st Cong., 3d sess.), he stated practically that a constant reliable navigation was the great desideratum; that he believed such navigation could be effected by the liberal expenditure of money; and that the necessity for some radical improvement and the expediency of the same seemed to be generally conceded, provided it could be effected in a satisfactory manner on such a plan as would commend general confidence.

According to Mr. Leighton, Mr. Roberts made a further very sensible observation (which Mr. Leighton admits will apply with equal force to-day), namely, that the question is not merely one of dollars, but it is of the first consequence that the adopted plan shall satisfy the sober good sense of the country, and shall in the end be productive of the greatest benefit. Such limitations show the whole matter to rest practically on the single basis where it has rested for the past one hundred years, namely, practicability and not possibility. As above stated, every engineer has agreed as to the possibility and desirability, up to its limits, of the storage-reservoir system from a theoretical point of view; but up to the present time, because of limitations imposed by existing laws as to land ownership and riparian

rights, because of the long time necessary to obtain practical results, because of the large cost of the work, because of the fact that the benefits to be secured would affect many parties and objects other than those directly related to navigation (to which at that time the federal appropriations solely applied), because of the doubt that the benefit to navigation alone would be in proportion to its cost to navigation, because it might not prove sufficient, because of the difficulty of persuading the general public and Congress to appropriate immediately the money necessary for the full completion of the storage-reservoir project, as well as because of many other minor reasons—because of all these our engineers have been influenced to favor and follow the other better-known method of river improvement, viz, the dredging, contracting, and canalizing of the river, knowing that this would show immediate local beneficial results and final permanent good results, and that such method had been tested and found useful by many years of actual experience.

4. The main point raised by Mr. Roberts (pp. 26, 29, 124, of his Apr. 21, 1870, report) was, that while he believed the reservoir plan to be theoretically practicable, he considered it at that date unattainable within the practicable limits of cost (being governed, of course, by his immediate surroundings as to funds and by the local conditions of his immediate time), reporting that any reservoir system, in order to secure 5 or 6 feet low-water depth in the Ohio River, would probably require at least 273 reservoirs (elsewhere stated as from 30 to 300), with dams of from 60 to 100 feet in height (very high for that day) at a first cost of at least $60,000,000 (elsewhere stated as from 30 to 90 millions), with at least half a million dollars more every year thereafter for maintenance, irrespective of accidents and other extraordinary contingencies. Mr. Leighton now suggests the use of over 100 very large reservoirs, occupying from 1 to 3 per cent of all the land area drained by each tributary (1 to 3 acres of every 100), with dams varying from 30 feet to 250 feet in height, all at a first cost of $125,000,000 and perhaps very much more.

5. There is apparently no question amongst engineers as to the advisability of storage reservoirs on all very large rivers, if (*a*) all or the greater part of the water can be conserved; (*b*) if the water flow in the river and the adjoining land on its banks can be obtained free of cost to the United States, or if the question of cost be of no account; (*c*) if time for construction be of no account; (*d*) if accidents to the dams during construction and operation be impossible; (*e*) if the water can be freely used for domestic, factory, and municipal supply, for power development, and land irrigation; and (*f*) if supreme control by the Federal Government is practicable; but it would be hardly possible to expect all these conditions to be fulfilled for many years to come. The question is, therefore, not what is advisable irrespective of the above conditions, but only how the United States can get the best general results for each dollar of cost under conditions of existing laws and existing local surroundings.

6. Heretofore, all river improvement in the United States under federal appropriations has, by existing law, been tied down to questions of navigation alone, irrespective of bank protection, of flood prevention and protection, of water power, and of irrigation. The objection to the storage-reservoir method has not been due to lack of suggestions by the United States Engineer Corps so much as the fact

that Congress, representing the general public, has been reluctant to enter upon an enterprise of such magnitude in cost and such great extension of federal powers as would result from extending river and harbor improvement so as to include the other improvements above mentioned.

7. Mr. Leighton's descriptions of the various Ohio River Valley basins and his subsequent computations as to resulting water levels during low water and during floods are an excellent and valuable compilation and calculation, and they bear every sign of being reliable so far as he has attempted to carry them. They show plainly a much more favorable condition for storage reservoirs in the Ohio basin than has heretofore been exhibited by anyone else. Above all other things they show what an enormous amount of potential water power is still awaitning development in the Ohio River Valley. If the local state legislature could be made to fully comprehend the situation, it seems hardly possible to believe that they would not take the matter in hand and enact such legislation as would permit and encourage a thorough development of this power by either individuals, corporations, municipalities, or the State itself.

It seems almost a crime to allow this wealth to remain undeveloped. But under existing law it is difficult for the Federal Government to interfere and assume control until a very much greater public benefit can be proven than is already in sight. The Great Kanawha River basin offers exceptional advantages for such treatment. If the Federal Government could forcibly take charge of all water power in this basin without compensation therefor and extend its reservoirs over about one-fiftieth of the whole basin, the power development would undoubtedly more than pay for the navigation improvements, no matter how made; but the present methods are absolutely regular and certain in their results and less revolutionary. It is possible that the storage-reservoir system would also have proved successful; but it is also possible that without federal assumption of power development the storage-reservoir system would have proved in the end equally expensive and not as certain. In almost all engineering work it is always considered best judgment to allow a coefficient of safety (to cover accidents, unintentional ignorance, and carelessness in construction and operation), and such coefficient seems hardly allowed for by Mr. Leighton.

8. There is no doubt that there must be a limit where the size, capacity, and number of the storage reservoirs will certainly allow sufficient storage to hold back floods. Mr. Leighton plans for enough to give good results; but he does what no one heretofore has considered within the limits of federal appropriations and public consent, viz, to occupy an average of 1.8 per cent of the entire area of all the basins named by him, and in one case occupying over 3 per cent. If this should prove popular, or even allowable and practicable, his plans will then merit much further approval than heretofore given by engineers.

9. Mr. Leighton makes no special reference to the valuable information and discussions which have appeared from time to time in the Annual Reports of the Chief of Engineers since the days of the reports of Mr. Ellet and Mr. Roberts (except his references to Major Chittenden and the 1905 board). While the reports of Mr. Ellet and Mr. Roberts were the first to start opposition in the United States to

the reservoir system applied to river improvement, the United States Engineer Corps has steadily given credit to the good features of the reservoir system; has given a practical first trial at the headwaters of the Mississippi River; has considered its use on the tributaries to the Mississippi between St. Paul and Cairo; and has been ready to extend the use of such system so far as seemed practicable. The real position to-day of the civil engineers of the country would seem to be very decidedly in accord with the report of January, 1881, by an engineer board consisting of Col. Q. A. Gillmore, Maj. C. B. Comstock, Maj. C. R. Suter, Mr. B. M. Harrod, and others (printed originally as H. Doc. No. 95, 46th Cong., 2d sess., and reprinted on pp. 2747–2754, Annual Report, Chief of Engineers, 1881), this board having been convened to consider especially the recommendations of Capt. C. T. Allen as given in his reports and projects of 1880.

The report of the 1881 board, while practically indorsing the modified system of reservoirs now in use on the upper Mississippi, states a decided opinion—that, omitting the question of cost, the reservoir system is the only system which would insure permanency and at the same time develop to the utmost the capabilities of a stream for navigable purposes; but that in order to efficiently supersede the other methods of river improvement the reservoir system must be of sufficient magnitude to control a large proportion of the river discharge, the direct benefits of the reservoir system being somewhat doubtful with the lesser magnitude of the development; and this report, while outlining the benefits and disadvantages of the reservoir system, brings out in special prominence the facts that the benefit to be secured to navigation from any reservoir system is to be measured principally by the rapidity and effectiveness with which it improves channel depths during the transition stage between floods and subsequent low water (by cutting out new channels through newly formed high bars) and by the added draft (distance from water surface to river bottom on the bar) which it gives at dead low water, rather than by the mere addition to the height of the low-water surface; and that the good effect during the transition stage, and the extent of such good effect, is yet to be proved by actual trial.

10. A subsequent report by a board, headed by Col. T. L. Casey (late Chief of Engineers), under date of May 24, 1887 (see pp. 1681–1693, Annual Report, 1887), convened especially to consider the results produced by the Pokegama Reservoir—the only one finished at that date—confirms the views of the 1881 board report; and while showing that this Pokegama Reservoir was able to raise the low-water levels in the Mississippi River 5.2 feet at 2 miles below the reservoir, 3 feet at 167 miles (Aitken), 1.5 feet at 383 miles (St. Paul), and nothing at 413 miles (Lake Pepin), this board states its conclusions that reservoir systems in general are economically advantageous only in regions of country where land has low value and where the population is small (private industries being interfered with the more as population increases); that such systems are advantageous not to replace other known methods, but merely as adjuncts thereto; and that the existing methods should still be given precedence in 1887 on the Mississippi (as yielding quicker and better returns) until such existing methods should be fully developed.

11. A still more recent board, headed by Maj. H. M. Chittenden, under date of November 27, 1905 (pp. 1443–1474, Annual Report, Chief of Engineers, 1906), considering the actual operations and results of the five reservoirs then in operation, which controlled 21.5 per cent of all watersheds above Minneapolis, reported that while finding that the reservoir system on the upper Mississippi River was there giving good results, was being operated by sound methods, and was then indorsed by the community as a whole, the existing five reservoirs had not added much more than 1.5 feet to the low-water stage at St. Paul through the three months of low-water season (considerable less to the low-water draft), failed to show any appreciable effect at Lake Pepin, and were still vigorously opposed by the owners of land above the reservoir dams who wished the land drained for agricultural and manufacturing purposes.

12. Even though the original reasons given by Mr. Roberts are no longer of the same force as when used by him, his general argument remains practically unchanged until to-day, the details having been modified by the changes which have occurred in the commercial, navigational, engineering, and social conditions of the country. Because of his reasons of 1870, Mr. Roberts gave up the storage system as impracticable at that date, and his views were indorsed by the United States Engineer Department. Although engineers of to-day are ready to enter upon much greater constructions than in 1870, and although Congress is now ready to make much more liberal appropriations than in 1870, there still seems very great doubt as to the advisability even to-day of substituting for existing methods the single method of storage reservoir construction, in view of the cost, the time occupied in construction, the difficulty of coordinating the interests involved, the extension of federal control necessarily required, and such other results as necessarily follow from the same. Some of the good and bad features of the reservoir method are given below in fuller detail.

### BENEFITS OF RESERVOIR SYSTEM.

13. Theoretically, and to the United States as a whole, the reservoir system carries great benefits: (a) In prevention of floods and protection against the same; (b) in improvement of low-water navigation; (c) in development of water power for manufacturing purposes; (d) in supplying a useful liquid for drinking, washing, sanitary, and chemical purposes, and for irrigation of land; and (e) in developing fisheries. Some of these benefits go to the public and some to private parties; and some of them apply above the reservoir dams and others below. The division of benefits between the public and private parties makes difficult the proper division of the cost of the work between the parties interested; and the division of benefits above and below the dam makes difficult the proper division of the use of the water.

14. Flood protection and prevention is largely a local matter. In many cases damage from river overflow is due mainly to the improper occupation of overflowable land by private parties, who do so because such land is naturally cheap at time of purchase, because they are willing to gamble on the chances of overflow, and because they have great hopes that they will eventually be protected in some way at public expense either by the local community or by the Federal

Government; and the proper treatment of such cases would seem to be the enactment of local laws to stop such future occupation until the local protection works are duly erected, rather than encouragement of such risks. In many other cases the overflow is largely due to the improper use of the river bed by private parties for the deposit of refuse and for the reclamation of land in private interests, thereby stopping the proper flow of the water courses, this being done without any respect for the consequent damage to other interests, and the proper treatment of such cases should be the enactment of proper local laws to stop further abuse. In both these cases actual intervention by the Federal Government is undesirable and only necessary in case that the local States are negligent of their own duties and of the public interests.

Except for the Mississippi River below Cairo, the cases of overflow in the United States which are strictly federal are usually the exception rather than the general rule, and, consequently, the construction and supervision (including their cost) of protection works should be treated as more local than federal. All exceptional cases, however, which can not be corrected by local laws seem very properly to come under federal control and then to be necessarily payable for at public expense.

15. The benefit to low-water navigation occurs mainly below the dams, the reservoirs, as a rule, being necessarily in the upper part of the river where the latter is likely to be unnavigable; and such benefit concerns the public in general more than private parties, and such benefit makes itself usually evident in the shape of reduced rates and increased capacity of general transportation and in the special control of railroad rates. The benefit to low-water navigation is not as great to the lower part of the river as it is to the upper part, and may be restricted to only a small portion of the river next the reservoir. Whether the benefit can actually be carried effectively over the entire length of the river in the manner indicated by Mr. Leighton for the Ohio is still unproved.

According to the latest reports on the upper Mississippi reservoirs (pp. 1465–1466, Annual Report, 1907) it has been found that such benefit, amounting at St. Paul to from 9 to 18 inches increased height of water stage (and less if measured in available draft of boats) for ninety days of the summer low-water season, affects only about 60 miles of the river from St. Paul down to the center of the Lake Pepin reach, and its effect below this reach is practically inappreciable.

16. The benefit from water-power development, under existing law and custom, goes almost entirely to private owners below the dams, and their interests are sometimes quite different from the interests of the general public, and are liable to lead to constant trouble. If the water power can be taken possession of by the Federal Government without payment, or even at reasonable payment for damage to riparian properties, the rent from the same may sometimes be safely figured to amount in a few years to more than the entire cost of the reservoir. If the Federal Government has to pay the riparian owner for the injury to his existing water power, the highest prices will undoubtedly be asked: on the other hand, if the United States rents the developed water power to adjoining property owners it is safe to assume that the public will expect the lowest possible rates, which will probably be much lower by the time the dams are finished

than they are at present. The estimated benefit figured by Mr. Leighton ($20 per horsepower annual rentage) seems much higher than can be counted upon in the future, as to which more details will be given later. The Federal Government will probably be fortunate if it realizes $10, or even $5, per horsepower per year.

17. The benefits from water supply and irrigation usually go to municipalities and private parties below the dams; and their interests will be almost entirely opposed and detrimental to those of navigation. On this account it will be exceedingly difficult to arrive at any reasonable arrangement of division of cost between the irrigation and navigation interests. The irrigation public will want the most water at the times when it is most needed by navigation, and they will want it at the lowest rates.

18. The benefits for fisheries will go largely to the public in general both above and below the dam. Under favorable circumstances it is estimated by the Illinois State Internal Improvement Commission that the fisheries may return to the general public a value of as much as from $10 to $20 per acre of water surface; but it will be so difficult to secure the return of any of this profit to the Federal Government that none of such revenues can be properly counted upon to assist in the cost of construction and maintenance of the reservoir system.

19. Major Chittenden, in his extensive and valuable report of 1898, shows quite clearly that the actual benefits coming simply from flood prevention and navigation improvement can hardly be expected in themselves alone to justify the construction of storage reservoirs. But where flood prevention by proper rainfall storage, can be combined with flood protection works the matter may become sufficiently public to demand state and sometimes federal control, and where it also is liable to greatly assist general navigation in the lower river it may properly authorize federal control alone; in which cases there ought to be some way by which the revenues and other benefits belonging to the newly created reservoirs and their water powers might legally be used to defray the cost of construction and operation of the whole improvement.

20. *Handling of reservoirs for flood prevention.*—Providing that weather can be forecasted with certainty and that the storage reservoir has no other object to perform than to store floods, and that there are no limitations as regards the size and number of reservoirs, the storage-reservoir system should, theoretically, be able to prevent all serious floods in the manner indicated by Mr. Leighton. But in order to always have sufficient water held back for the low-water season it is hardly probable that the reservoirs will uniformly be in condition to catch the results of a sudden storm; as for surety in such matters, the reservoir should be kept only three-fourths to one-fourth full during all the months subject to flood, which means nearly half of the year. When a heavy rainfall is expected and actually forecasted, the time will always be too short for drawing down the reservoir to any large extent. Quick run-offs of water into rivers immediately after heavy rain storms are to-day largely due to the existence of roads, gutters, sewers, drains, clearings, etc., which are now everywhere established by cities, towns, counties, and all intelligent farmers and landowners. This element of quick run-offs will increase rather than diminish during coming years. Some of it may be held back by a proper system of reforestry, but not much.

21. *Handling of reservoirs for low-water improvement.*—The impossibility of forecasting with certainty a coming wet or dry summer, and the length of time which it takes for water released from the reservoir to reach the lower river, make it necessary for the improvement of low-water navigation to commence water storage early in the wet season, to hold the reservoirs full until the dry season is actually in evidence, and then, after starting the low-water flow, to keep it fairly regular and well ahead of its demand.

22. On the upper Mississippi River it has been found that the progress downstream of released water was twenty-one days for the first 70 miles, and sixteen days for the rest of the distance down to St. Paul. On the Ohio River the crest of a heavy flood requires seven days for passage in the open river from Pittsburg to Louisville, where conditions are many times better than in the Mississippi River above St. Paul. In order that the water shall run off freely when released, the river must be straightened and its sides and bottom made comparatively smooth, and the increase of current thereby caused is not always advantageous. It is still somewhat doubtful whether the amount of water flow named by Mr. Leighton would in actual practice be sufficient to keep the river steadily up to the levels named by him during the low-water season, and, if so, whether the river bottom will not be raised by the formation of new permanent bars so as to make the gain in available draft much less than the gain in stage. On the upper Missouri, within the limits of North and South Dakota, there is only a draft of 3 feet at a 5-foot stage of water, while there is often 3.5 to 5 feet draft at dead low water, the crest of bars rising with rising water. On the Mississippi River, from St. Louis to Red River, the rise of bar crests is about half the rise of the river, giving below St. Louis only 14 feet on the bars at a 20-foot stage above low water.

23. On the Ohio River in the past, a few attempts have been made to use the stored-up water of the Kanawha River slack-water dams, to send a flood wave down the Ohio River and thereby to carry through from the mouth of the Kanawha River to Louisville the coal fleets which had accumulated in the Kanawha. So far as these particular coal fleets were concerned, the experiment was fairly successful, but it was found that the water ran off so much more rapidly than was expected, that unless each coal fleet could keep close after the crest of the artificial flood, it was caught by falling water and was stranded on the river bars. These few experiments were not continued, because of the numerous protests against the same made by the local raft and boat owners down the river, as under the unexpected rise their log tows might float out over the bank or strand on shoals, and boats which had been insecurely moored on the banks might float away by the unexpected rise, and property (deposited freights) unloaded on the river bank by steamers might be submerged before it could be taken away. Of course, much of this trouble could be obviated if there were an extensive telegraph and telephone and patrol service all along the river bank; but even then the irregular fluctuations are undesirable.

On the upper Mississippi, where regularity of release of stored water is undoubtedly desirable, several different methods were tried; and eventually it was found best to hold back the water so far as practicable (allowing for the time necessary for released water to reach the point of its use) until the water stage in the lower river approached that desired to be preserved during the low-water season,

and then to release at first a small amount of water, afterwards more, increasing the same as the river stages fell and diminishing the same as the river stages rose, with a view to keeping the stage in the lower river fairly constant at, or a little above, its desired minimum. Although such method as above stated has secured on the Mississippi a 9 inches to 18 inches increase of low-water stage (with less gain in draft) at St. Paul, and although it is hoped and expected that this can be held during nine years out of ten, the actual permanency is yet to be proved. It is quite possible that the volume of stored water in these reservoirs, available for use, may later be increased by dredging a lower outlet (canal or tunnel) to the reservoir, by which the reservoir may be drawn down to lower levels than heretofore. Where such arrangement is practicable, such method may often be more economical and useful than to attempt to get an equivalent extra storage by building higher dams and overflowing larger areas. But all this work is still more or less tentative and the proof of permanent good results must depend upon long actual practice. The extent of success possible where dams shall be many times larger and many times more numerous than on the Mississippi, while undoubtedly greater than so far obtained, is still quite debatable.

24. The above brings out forcibly one fact, namely, that regularity of storage-reservoir flow must either depend upon or lead up to an extensive system (*a*) of measurements of rainfall, run-off, gauge heights, storage, and water release, at the reservoirs; and (*b*) measurements of gauge heights and currents, in the river below; and to an extensive system (*c*) of information service (including telegraphs, telephones, and patrols) to the boating and landed interests in the river below. The proper development of these must necessarily take much time, and will require large appropriations for the first and each subsequent year.

25. *Cost of the reservoir system.*—The cost of reservoir construction, will, of course, be very great, and Mr. Leighton apparently admits this by his estimate of $125,000,000 for the Ohio River.

26. Such a system is practicable in Russia or India (where it has already been extensively adopted) mainly because land is exceedingly cheap, and labor is equally cheap. Similar features made comparatively cheap the construction of the five existing upper Mississippi reservoirs in Minnesota; but the cost of these reservoirs would probably be very much greater if such constructions were to be duplicated, commencing to-day. The American public are already beginning to realize the prospective value of water power as well as of land, and are beginning to charge high for the same and to obtain high compensation for the same under condemnation suits. (For further details, see first paragraph under head of "Special objections" below.)

27. Moreover, Mr. Leighton bases his approximate estimate of cost of a reservoir system on the cubic contents of his reservoirs; but considering the much greater value of land in the Ohio Basin than in the localities where preceding reservoirs have been built, and considering the great height of his reservoir dams and the consequent expensiveness of the same, it would seem to be much more proper for him to base his figures on the acreage of reservoir site, and on the square of the height of his dams, than on the mere capacity of the reservoir itself.

28. Besides, occasional accidents must be expected and should be estimated for, and to-day the business public are accustomed to a capitalization of the cost of insurance just as much as of the cost of other operations, and to the addition of the same to the first cost of construction when determining the total final cost of new works, which, of course, has not been done in this case. (See further under "Special objections" below.)

29. Any person estimating to-day upon the cost of dams will find valuable information in condensed form in the extensive tables compiled by Morris Knowles and printed as an appendix to a discussion of floods and their prevention on the Ohio River in the printed proceedings of the Engineers' Society of Western Pennsylvania for July and October, 1907. These tables contain most of the information previously given by the 1895 Massachusetts State board of health reports, by the 1897–98 Annual Reports, Chief of Engineers, U. S. Army, by the 1899 edition of Wegmann, by the recent annual reports of the United States Reclamation Service, and by recent engineering journals.

30. The eventual cost of a satisfactory system will probably go very far beyond the $125,000,000 of Mr. Leighton's estimate, perhaps to ten or twenty times such amount.

31. *Extent of area needed for reservoirs.*—If the reservoir system is to be a success it must be of great magnitude. Major Chittenden in his 1897 report (p. 2852, annual report, 1898) states that he considers a storage reservoir as having capacity enough to prevent floods if it is large enough to store one-fourth of the annual rainfall. Mr. Leighton apparently does not differ very far from Major Chittenden in his estimate. At any rate, Mr. Leighton apparently recognizes the necessity for a system of considerable magnitude, for in his article he provides for the Ohio River over 100 reservoirs, whose area is approximately 1,700 square miles, storing the outflow from the river basins of 93,000 square miles, total area; so that his reservoirs (although many of them are of great depth) occupy, as above stated, on an average 1.8 acres out of every 100 acres of river basins of the tributaries containing the reservoirs, and in some cases, as on the Little Kanawha and Big Sandy, even as much as 3.4 acres out of every 100 acres on the river basins. Considering the opposition that is liable to arise from submerging such a large proportion of the farms, roadways, and perhaps occasional villages, the sanitary protests that may come from the repeated partial emptying of the same, to say nothing of the cost of the land itself and the dams, it is quite doubtful if the United States is prepared, even at the present time, to go into such an extensive development.

32. *The time for construction of reservoir systems.*—As has been intimated above, one of the drawbacks to storage reservoirs is the fact that the first constructions give no very appreciable results, unless the reservoirs are of unusually great capacity. Even then the effect of the first one or two is rather disappointing; and the public will be very liable to lose enthusiasm long before the system is completed. On the upper Mississippi River the original project proposed 41 reservoirs. the proposition being first agitated about 1868; it was 1874 before Congress could make any appropriations for surveys, and by that time the number of reservoirs to be immediately built was cut down to seven. In 1908, forty years from the first movement, the actual reservoirs built number only five, and, as

has been above shown, the result in the way of assistance to low-water navigation, while valuable, has only been to add about 1.5 feet to the previous low-water stage and less to the available draft. At the rate of forty years for construction of only five dams on the upper Mississippi River, it might take fifty years to get 100 dams on the Ohio, even admitting full value for all reasonable gain in public sentiment due to the good results already obtained on the Mississippi.

33. *Value of water power.*—While the water power which may be developed by the surplus water of storage reservoirs will be, of course, quite valuable, Mr. Leighton's estimates on the same are considered as too optimistic, especially in his figuring on one-half of the water being available for economic development and being worth $20 per horsepower year.

34. The Engineering News in 1895 shows that on the old hydraulic tunnels at Niagara, N. Y., the water power was rendered sometimes as low as $4 per horsepower year and that on the newer tunnels the rent varied all the way from $21 in small quantities down to $10 per horsepower year in large quantities.

35. The Engineering News in 1900 (p. 49) shows rates sometimes less than $4 per horsepower year at Manchester, N. H., and Lowell, Mass., and rates less than $8 per horsepower year at Bellows Falls and Turners Falls, Mass., all in New England, where factories are numerous.

36. The Annual Report of the Chief of Engineers for 1906 (p. 1469) shows rates less than $6 per horsepower year at Minneapolis, Minn.

37. The Chicago Sanitary District Canal, while hoping for $20 per horsepower year, is already seeing that it will be fortunate if it secures an actual $12 on an average for the entire surplus power.

38. In the new canal which is now being proposed in Canada for heavy-draft boats from Lake Huron, via Georgian Bay and the Ottawa River, to Ottawa, on the lower St. Lawrence River (see Engineering News, Oct. 3, 1907, p. 370), Canada is figuring on receiving only $12 per horsepower year for its surplus water power.

39. While parties who can exercise a monopoly may properly expect high rates for their surplus water power, the Federal Government, as well as state governments, can not safely expect to receive anything more than the lowest rates given to other parties—perhaps even lower—and, in any case, rates that are close to actual cost. The general sentiment of the country is that a public business is to be conducted for the public benefit rather than for the purpose of making profits, and if the Federal Government takes up the business of furnishing water power to the people it must be prepared to place the matter on the same basis as the Post-Office Department, which is obliged to ignore any question of direct profit.

40. If power development for federal use is desirable, such power might in many cases be obtained in connection with slack-water or lock and dam improvements by using the existing pools unchanged (as has already been done to some extent on the Muskingum River) or by building its dams higher or by constructing feeder canals from existing pools to power houses at advantageous points below. This might have been done in past days, and might still be done to-day, at St. Paul, Des Moines, Louisville, the Kanawha River, Tennessee River, and various other places. In some recent cases by congres-

sional authority private parties have been allowed to construct dams or erect power houses on federal dams in navigable rivers (for example, the Tennessee River, Ala., and Rock River, Ill.) under condition that they either provided locks or lock sites or furnished other compensation to the Federal Government to assist public navigation. Much more might probably be done in such direction with benefit to the general public. But public sentiment and congressional action are not yet specially favorable thereto.

It is quite probable that the present general feeling of the country is voiced by the statement in the House of Representatives on February 6, 1907 (Congressional Record, 1907, p. 2411), to the effect that although a general statute might be framed that would give to the United States Government control of water power along navigable waterways, there is no existing authority allowing the acquisition of such water power; and even if acquired it would have to be paid for under condemnation proceedings; and that it is questionable whether the Federal Government at present desires to go into such an enterprise merely for its water power.

41. *Some special objections to the reservoir system.*—As above indicated, storage reservoirs usually benefit existing conditions below the reservoir dam and usually injure existing conditions above the dam, so that extensive compromises are necessary between the conflicting interests. The 1905 board on the Upper Mississippi River reservoirs found on this river at that date at least seven of these conflicting interests, all of which had to be harmonized. If the storage reservoir is to be used primarily for benefit to navigation, it will become necessary for the Federal Government to assume positive and complete control and to indemnify the injured parties for the majority of their claims.

42. The existence of a storage dam will cause the overflow of large areas of land, mainly above the dams during water storage and secondarily below the dams during water release; such overflow may seriously injure or totally destroy the river bottoms for farming purposes or for resident sites or for manufacturing sites, and such bottoms being usually of rich soil, will be naturally held as specially valuable; and such overflow may interfere seriously with highway travel during the high-water stages of every flood, causing long detours to such travel. The storage reservoir may also injure existing or potential power plants mainly above the reservoir dam by destroying either the waterflow (valuable for paper mills and other factories needing good water) or destroying the head of water, which might otherwise have been serviceable for local power plants. Under the existing laws as regards riparian rights, the landowner in the majority of the States of the Union has heretofore enjoyed the undisputed right to all uses of the land so far as not overflowed under natural conditions of the waterflow, and similar right to the use of all water front along his property.

A recent brief article on this subject in the November, 1907, issue of the American Political Science Review, by R. H. Hess, of the University of Wisconsin, upon "The passing of the doctrine of riparian rights" shows that this doctrine is at present undergoing considerable revision throughout the United States and must soon undergo still further revision; but at the same time this article shows quite clearly that until such doctrine shall have been legally modified

by constitutional enactments of the various States not only the individual States, but also the Federal Government, must abide by existing laws. Under such circumstances the construction of storage reservoirs means that the individual States or the Federal Government must compensate the riparian owner for his loss either by payments in money or in water power, thereby either purchasing or renting the overflowed land or paying damages for the right to overflow them, the price being usually fixed by condemnation proceedings, owing to the extreme difficulty of reaching any equitable result by private arrangements.

A compensation by payment in either water or water power, while occasionally made in the past by the United States, has almost invariably been found to result in serious later troubles, so that in general it is found necessary in the end to buy outright all land subject to overflow and to buy all water flow and water power subject to injury. All this means not only great expense in money, but also long delays in time. Any payment in compensation by furnishing water flow or water power may be no serious inconvenience during high-water stages, but is sure to become troublesome and costly during low-water stages, when navigation wants all the water which can be spared. Power companies which usually commence with having more water than they have use for almost always eventually arrive at a stage of development where their demand for water exceeds the supply. As the power companies will then wish to use more water than the average of the season, they will then endeavor to use the water steadily and to their fullest capacity throughout the winter and at other times when navigation interests will wish to hold it back for storage, by which use the reservoir will be drawn down to its lowest point considerably before the low-water season arrives, the power company having arranged to supplement its own lack of water during the low-water season by the use of steam power, leaving the navigation interests short of water at the very time when they need it most. Such treatment of water pondage is already a matter of actual practice. The power companies are naturally looking for profits, and as soon as they find that they can get a higher return out of the whole year by this method they will use every endeavor to do so. Even with such a big reservoir as Lake Superior, the conflict between the water-power demands for water supply and navigation demands for water storage is already a fact of record.

43. Where storage reservoirs are intended to prevent floods as well as to improve navigation at low-water stages, there is a further difficulty, viz, that, for the best prevention of floods the storage reservoir should be emptied as rapidly as practicable as soon as such heavy rainfall is well over, so as to have the reservoir empty at the time of the arrival of the next flood; whereas for the best interest of low-water navigation it is desirable to keep the reservoir entirely full until the commencement of the dry season, and perhaps one-fourth full for emergencies until the dry season is nearly ended.

44. Another serious objection to the storage reservoirs, is the great element of danger in case of any accident to the dam while full. While the loss to property from annual freshets on a river like the Ohio is enormous, it is small in comparison with the loss of life and property which might result from the bursting in either the Allegheny or Monongahela River of a single dam 250 feet high, and

containing 20,000,000,000 cubic feet of water. Until the arrival of at least another generation of people, who shall have forgotten the horrors of the Johnstown flood, it is probable that Pittsburg and the other large cities on the upper Ohio River will protest vigorously against the construction of many large and high dams on the river above them.

45. In comparing reservoir systems with slack-water improvement of rivers, the reservoir system suffers a further disadvantage in that very little good result can be expected until the system is nearly complete, or until, on the Ohio River at least, $100,000,000 have been spent; whereas in slack-water improvement the construction of each dam gives an immediate local benefit of much magnitude. Reservoir dams are rarely located in regions where they can be directly useful to cities, factories, or general navigation; but slack-water dams across rivers are very often placed below large tributaries and below large cities, where they establish extensive and deep quiet-water harbors above each dam available at all ordinary river stages, and especially valuable to the large commercial centers near them. On the Ohio River, although the present slack-water system provides for 6 to 9 feet depth of water, each of these slack-water dams establishes pools averaging 20 miles each in length whose lower half is from 14 to 17 feet deep. The river front along these pools, therefore, becomes immediately of great value to factories and commercial houses, and the value of land along each bank is immediately and greatly increased. For such reasons, on the upper Ohio, between Pittsburg and Beaver, where five dams have already been built at a cost of about $5,000,000, the increase in value of the mere land on one side of the river due to the development of deep slack-water pools was from two to four times the total cost of all five dams.

The same results are to be expected farther down the river at Wheeling, Parkersburg, Cincinnati, Evansville, and Paducah. The slack-water dams below the mouths of large tributaries are also valuable to the steamboat interests of both tributaries and of main river, because furnishing a place below the mouth of the tributary where the local towboat fleets can be assembled for downstream travel, or where these fleets can be broken up prior to going up the main river or up the tributary. Such harbors also make possible for about half the length of each pool the establishment of systems of permanent docks with vertical fronts, and they make unnecessary to a large extent the use of the former floating docks, which require to be constantly moved up or down the river banks as the water varies between high and low water stages.

46. While the reservoir system assists the down passage of boats by furnishing a comparatively clear channel for navigation at all times of the year, the increased current will delay the up passage of boats. For a round trip downstream and back again there is probably not very much difference between the total time necessary under a storage reservoir system and a system of slack-water improvement.

47. *Summary.*—Briefly stated, the main objections to the adoption of a storage reservoir system to replace existing systems of river improvement in the United States, as recommended by Mr. Leighton, are as follows:

48. The United States does not seem to be yet educated up to the point of the extensive appropriation of land and the great expendi-

tures necessary for effective storage reservoir systems, nor to the federal ownership of power dams, nor has it yet legally modified the doctrine of riparian rights sufficiently to allow of taking possession of existing water powers without due compensation to the former owners. The day may come when the United States will feel prepared to start in upon such propositions; but until that time, the executive departments must be prepared to proceed slowly in all such directions.

49. The storage reservoir system alone will not produce valuable results until it is nearly one-half or two-thirds completed, which will take very many years; during which time the lack of immediate results will cause much dissatisfaction to the navigation interests, who need immediate benefits, and to the general public, who are paying for the work.

50. The army engineer board of 1881, and all subsequent civil engineering reports, appear to either admit or fail to disprove the necessity of considering a storage reservoir system as merely an adjunct to the other existing methods of river improvement rather than as a system which will be complete in itself. Undoubtedly dredging, contraction works, and bank protection, and perhaps even a large proportion of the locks and dams now looked forward to, will be necessary even with a perfect storage reservoir system. The slack-water system, as applied to the Ohio River, has already proved to the general public its ability to do the work which it proposes to accomplish, and such improvement is now generally understood and accepted. It seems very inadvisable to abandon an already proven and generally approved method, in order to adopt another not positively proved successful and which may require another twenty years to be thoroughly understood and appreciated and which even then will only supplement and not entirely replace the existing system. The slack-water system of improvement for the Ohio River has now reached such a stage that its successful accomplishment could be arrived at at any time within not more than six to eight years from the date when the funds are provided; and the cost of the same, even at the highest estimates of to-day, will only be about two-thirds of the low estimates of Mr. Leighton for the storage reservoir system.

51. While details of the objections raised by W. Milnor Roberts in his report of 1870 have changed with the growth of the country and of navigation plant and interests, his general objection of 1870 and those of the engineer board of 1881 to the use of the storage-reservoir system as a replacement of other methods are still serious ones and will still be supported by the practical judgment of the general public.

52. At the same time the storage-reservoir system, theoretically and as viewed from all its aspects, has enormous possibilities and advantages for the public at large and should be looked forward to as something exceedingly desirable as soon as law and general public sentiment are ready for the same; and it might be exceedingly desirable, from this point of view, to encourage the establishment of at least a few large storage reservoirs in the Allegheny and Monongahela river basins as an adjunct to the existing slack-water system of the Ohio River, as already approved by Congress.

If these first few storage reservoirs prove acceptable to the community and receive the necessary authority and appropriations of Congress, their construction and operation can not in any way injure

existing navigation, ought to assist very materially the other improvements now in progress, and will serve as a valuable object lesson to the general public and to the engineering profession. As, however, the local benefits which will come from such reservoirs on the Ohio River will be felt most extensively and mainly in the prevention of floods, the protection of river banks, the development of water powers, and the establishment of water supply for domestic and manufacturing uses in the State of Pennsylvania it would seem as if public sentiment for the same should first be created inside of the State of Pennsylvania, and the cost of the same should be paid for mainly by state appropriations or by the local corporations and individuals most directly benefited. Meanwhile the navigation interests of the Ohio River and all the influence of the Ohio River Valley Association will protest vigorously against any step which shall delay in any way the rapid completion of the existing slack-water improvement of the Ohio River which they already are acquainted with and know to be possible of giving the results which they desire.

53. *Suggestions.*—If it is thought advisable to develop further the storage-reservoir system in the United States to assist navigation, then probably one of the best places for such further development would be on the Mississippi River, between St. Paul and St. Louis, by an extension of the existing upper Mississippi system in such way as to cover the tributaries of the Mississippi between St. Paul and St. Louis (in the manner outlined by the 1880–81 reports of Captain Allen), with a view to securing a greater low-water depth from St. Paul to Cairo. This would help existing work, and might give very useful results at reasonable cost.

54. Until the time comes when the Federal Government is prepared to assume full control of water powers on navigable rivers, it might possibly be well for the Federal Government to give long-term leases of all its river rights, except navigation, to private associations or corporations, one or more in each river basin, on the condition that each association shall assume all cost and other financial responsibility of construction and operation of its dams and pools, and that in addition it shall build a proper boat lock or at least furnish a lock site at each dam, and shall guarantee to navigation a definite minimum stage above each dam, and minimum flow past each dam, during each of the low-water months of each year, all free of cost to the United States. Wherever the existing law allows the Federal Government the right to condemn land and flowage, these rights might be turned over to the dam owner or lessee, so as to simplify his legal difficulties. Under such conditions, it might be possible for the dam owner or lessee to even pay the United States a low rental for each horsepower per year thereby obtained, and still make a reasonable profit on his investment. Such an experiment might easily be tested in the upper Mississippi Valley below St. Paul. The result could hardly make the Mississippi River water flow any more irregular than at present, and would undoubtedly raise the water stage a good deal, and might increase the boat draft quite appreciably. The risk would be small compared with the possible gain.

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*Lieut. Col., Corps of Engineers.*

Chicago, Ill., *January 11, 1908.*

# THE WATERWAYS OF THE UNITED STATES: ACTUAL EXPENDITURES AND RESULTS TO NAVIGATION AND COMMERCE.[1]

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This paper is presented in view of the interest manifested of late in the improvement of our waterways and the number of references thereto in the public press, some favoring and some opposing this class of work. Many of those offering contributions on this subject are optimistic in the extreme, prophesying the most extravagant and improbable benefits to follow large expenditures for these improvements, while it is not unusual to find those who claim that expenditures for these purposes are a useless waste of public funds resulting in no actual benefit either in the way of physical improvement or of increase in commerce. Some even believe that navigation is on the decline and that actual commerce handled by water has decreased. It is the purpose of this paper to show as clearly as possible the actual facts in the case, as derived from a careful analysis of the records so far as they throw ligth upon this subject.

With a view to showing the total expenditures, the original and present depth, the change, if any, the original and present commerce, and the corresponding increase or decrease, an examination has been made of every project upon which the Federal Government is now expending public funds, from the most expensive harbor of refuge or slack-water system of river improvement down to the shallow streams on which small expenditures are made in the removal of snags. A small number of the minor works now under way are not taken into consideration on account of their insignificance, the small expenditures involved, and the meager data regarding them. This number is but a small fraction of the whole, and therefore can be omitted without prejudice to the general results sought.

The latest information available on the subject under consideration is contained in the Annual Report of the Chief of Engineers for the fiscal year ending June 30, 1908. Earlier reports have also been consulted. Some of the works have been under way for many years, and the expenditures shown are in each case from the inception of the work to the close of the fiscal year 1908. While data regarding expenditures upon all works are available, early reports contain but meager information in regard to commerce. It would be desirable to compare the commerce at the time of the inception of the work with that of the present time, but this can not be done

[1] In this as in other documents issued by the Commission no responsibility is assumed for the statistics contained.

except in the case of a very small number of works of recent date. In the earlier days commercial statistics were not complete and in many cases were entirely absent or are now considered of doubtful value. In some instances the commerce was estimated in dollars, while in others it was given as so many packages, crates of merchandise, etc., the weight and value of which can not now be ascertained. It was not until about 1890 that particular attention was given to the collection of statistical data, and the items referred to below as original commerce are the averages of the first few years of reliable data, usually pertaining to the period from 1890 to 1895. The present commerce is an average of the last two or three years, except in a few instances where the growth has been steadily on the increase, in which cases the past year's commerce is given. The comparison therefore between original commerce and that of the present time covers a period of only about fifteen years.

It is found that the total number of works upon which the United States Government is engaged is 495, and it is obvious that it would be impossible in this paper to give the details of each, although they have been worked out. In order, however, to show a comparison of results, the several kinds of works have been classified and those of similar character grouped together. The reason for this is that it would not be proper to combine the cost and results at an important commercial harbor, having a costly jettied channel entrance, with those of a small inland stream; but a comparison of a number of the same class of improvements will give a very fair understanding of what has been accomplished. For this purpose the 495 improvements have been grouped into eight classes, and from an analysis of the details of the several groups the following results have been obtained:

*Class I.*—Harbors of refuge which are used solely for the protection of shipping and which show no results in regard to depth or commerce. Examples: Sandy Bay harbor of refuge, Massachusetts; Delaware breakwater, mouth of Delaware River; Harbor Beach, Mich.; deep-water harbor at San Pedro, Cal. The number of these harbors is 24, and they have cost $14,312,000. Seven of them report having sheltered 10,775 vessels in 1907.

*Class II.*—Harbors which are used both for refuge and for commercial purposes. Examples: Rockland Harbor, Me.; Gloucester Harbor, Mass.; Block Island Harbor, R. I.; Marquette Harbor, Mich.; Oswego Harbor, N. Y. The number of works in this class is 24 and the amount expended on them $24,083,772. Thirteen show an increased depth, ranging from 5 to 26 feet, aggregating 125 feet; 11 either show no change or there is no information available in these cases. The total original commerce was 34,876,000 tons; the total present commerce is 50,801,000 tons, showing a net gain of 15,925,000 tons. Of the total number of improvements, 21 show a plus commerce amounting to 19,484,000 tons, and 3 a minus commerce amounting to 3,559,000 tons. Assuming Government money to be worth 3 per cent, the total cost to the United States of this class of improvements is $722,500 annually, or, on the basis of the present commerce, 1.4 cents per ton.

*Class III.*—Lake and coast commercial harbors, also tidal rivers. This is the most important class, as it includes not only the principal ports, but also a large number of tidal streams emptying into the seas, lakes, and bays. Examples: Newburyport Harbor, Mass.; Boston

Harbor, Mass.; Providence River, R. I.; Harlem River, N. Y.; New York Harbor, N. Y.; Delaware River; Potomac River; Savannah Harbor, Ga.; St. Johns River, Fla.; Galveston Harbor, Tex.; Ashland Harbor, Wis.; Ludington Harbor, Mich.; Oakland Harbor, Cal.; Humboldt Harbor, Cal.; Grays Harbor, Wash. The number included in this class is 265, on which the expenditures have been $172,707,900. Of these, 240 show an increase in depth ranging from 1 to 23 feet and amounting to a total of 1,558 feet. Twenty-five report no change, or there is no information on the subject. The total original commerce was 167,465,000 tons; the present commerce, 353,585,700 tons, showing a net gain of 186,120,700 tons. Of the total number, 175 show an increase in commerce amounting to 199,111,500 tons, and 68 show a decrease in commerce of 12,993,800 tons. At 3 per cent the total annual cost to the United States is $5,181,237, or, on the basis of the present commerce, 1.5 cents per ton.

*Class IV.*—Rivers under improvement by regulation or by locks and dams. Examples: Merrimac River, Mass.; Cape Fear River above Wilmington, N. C.; Alabama River, Ala.; Black Warrior River, Ala.; Arkansas River; Mississippi River; Monongahela River, W. Va., and Pa.; Kanawha River, W. Va.; Sacramento River, Cal. The expenditures under this class include the total amount that has been expended by the Mississippi River Commission, over $53,000,000, and also $23,000,000 provided by continuing appropriations for the operation and maintenance of the several locks and dams and for continuing snagging. The fact is well known that a large part of the funds used on the lower Mississippi River has been for the construction of levees, the benefits from which are far-reaching and not confined to commerce or navigation. The total number in this class is 76, and the expenditures on them amount to $204,718,500. Thirty show an increase in depth ranging from 1 to 8 feet, aggregating 101 feet; 46 either show no change or the data are not available. It may be stated as a fact, however, that in many instances where no increase throughout has been reported for this class of work, there has been marked improvement on certain stretches covered by the actual work done, the lack of favorable results on the project as a whole being due to the incomplete condition of the work. Total original commerce of Class IV, 49,155,000 tons; total present commerce, 64,374,000 tons; net gain, 15,219,000 tons. Forty-three show a plus commerce amounting to 25,036,000 tons; 22 show a minus commerce amounting to 9,817,000 tons. The annual cost to the United States at 3 per cent is $6,141,555, or 9.5 cents per ton on the basis of the present commerce.

*Class V.*—Interior shallow streams under inexpensive improvement such as snagging, removal of obstructions, a small amount of dredging on shoals, etc., designed to make existing depths available rather than to produce any appreciable improvement in physical conditions. The work is intended only to keep the rivers in a navigable condition. Usually these streams have a low-water depth of from 1 to 3 feet. Examples: Little Pedee River, S. C.; Upper Tombigbee River, Ala.; Yazoo River, Miss.; St. Francis River, Ark.; Snake River, Oreg., and Wash. Number of works, 67; amount expended, $7,200,900; no increase or decrease in depth. Total original commerce, 3,161,000 tons; total present commerce, 5,019,000 tons; net

gain, 1,858,000 tons. Thirty-three show a plus commerce amounting to 2,517,000 tons, and 16 show a minus commerce amounting to 659,000 tons. Annual cost to the United States, $216,000, or 4.3 cents per ton.

*Class VI.*—Inland waterways and canals. Examples: Inland waterway from Savannah to Fernandina; inland waterway from Franklin to Mermentau, Illinois and Mississippi Canal. Number of works, 7; amount expended, $9,956,600. Three show an increased depth ranging from 4 to 7 feet, aggregating 15 feet; 4 are deficient in data. Total original commerce, 1,331,000 tons; total present commerce, 3,272,000 tons; net gain, 2,941,000 tons. Three show a plus commerce amounting to 2,203,000 tons, and 2 a minus commerce amounting to 262,000 tons. Annual cost to the United States, $298,698, or 9.1 cents per ton.

*Class VII.*—Special work, auxiliary channels, removal of rocks, etc., affecting main through navigation only indirectly and which show no effect upon commerce. Examples: Removal of rocks at Hell Gate, N. Y.; closing Pass a Loutre, Mississippi River, La.; harbor at Vicksburg, Miss.; harbor at Pittsburg, Pa. Number, 12; expenditures, $11,264,432. These show no commercial results.

*Class VIII.*—Channels connecting the Great Lakes. While the number of works falling under this head is small, they are grouped together and treated separately on account of their great importance and the weight they would carry if included in any other class. They consist of St. Marys Canal, Hay Lake and Neebish channels, Detroit River, St. Clair Flats Canal, and connecting channels. Number of works, 5; amount expended, $25,198,000. All show an increase in depth ranging from 7 to 16 feet. Original commerce, 25,000,000 tons; present commerce, about 75,000,000 tons, an increase of 50,000,000 tons. Annual cost to the United States at 3 per cent, $755,940, or just 1 cent per ton.

Summarizing the above, it is found that the total expenditures on the 495 projects amount to $467,860,600; total original commerce, 281,760,000 tons; total present commerce, 591,977,700 tons, a gain of 340,217,700 tons; number of projects showing an increase in commerce, 217; number showing a decline in commerce, 111; excess in number showing increase over decrease, 106; annual cost to the United States at 3 per cent, $14,135,970, or 2.4 cents per ton. Of the 374 projects designed ultimately to produce increased depth, 288 show an actual increase ranging at the different localities from 1 to 26 feet, and aggregating 1,814 feet. The remaining 86 show either no appreciable results or information is lacking, the latter applying in the majority of cases, although in not a few instances advantageous results are shown for short distances covered by works only partially completed, actual benefits not being expected until the work has been further advanced.

The total of all expenditures on rivers and harbors since the inauguration of the work, nearly a century ago, is about $511,000,000. The difference between this sum and the one reported as having been expended on existing projects represents the amount expended on a few unimportant existing improvements, not taken into consideration on account of meager data concerning their commerce and physical condition, and a number of obsolete projects of earlier days which have long since been discontinued.

The question of the total actual amount of existing commerce handled by water is an interesting one and is difficult of solution. As stated above, 591,977,700 tons are reported as applying to the localities upon which expenditures are being made. Some of this is necessarily reported in duplicate, and some of it even in triplicate or quadruplicate. The explanation of this is that each work reports the commerce affected by or using it. As an extreme example, the tonnage in iron ore from Lake Superior ports is first credited to the locality from which it is shipped, then to the St. Marys Canal, then to the Detroit River, and finally to the Lake Erie harbor where it is transferred to smelter or rail. Again, coastwise traffic is usually reported in duplicate, first at the point of shipment and again at the port of destination. The exception to the general rule is in the case of foreign commerce and that pertaining to a few rivers where the traffic is local. An effort has been made to ascertain the amount of the actual water-borne commerce in the following manner, and it is believed the results approximate the truth.

The total commerce reported for the several harbors and connecting waterways of the Great Lakes is found to be 268,963,000 tons, including that passing through St. Marys Canal and Detroit River, which amounts to 114,926,000 tons. Deducting the latter amount, we have the actual commerce passing from one port to another, 154,037,000 tons, and one-half of this sum, or 76,968,500 tons, represents the actual existing tonnage of the Lakes. To this has been added the foreign commerce of our seaports, which amounts to about 35,000,000 tons, and one-half the coastwise and river traffic, which amounts to about 288,000,000 tons and which is reported in duplicate. The river traffic is the most uncertain of definite determination for the reason that, as already stated, some of it is local and reported but once, while in cases like the Tennessee River it is reported more than once, and a part of it enters into the amount reported for the Ohio River. The same may be said of many of the tributaries of the Mississippi, a part of the commerce at least of most of these streams being credited to the river in which it originates and also to the river in which it finds its destination. The amount of this commerce is not large when compared with the whole, and the method adopted is believed to offer the best and at least approximate results. From this method of calculation the total actual existing water-borne commerce of the United States is found to be approximately 256,000,000 tons per annum. On the basis of this actual commerce, the cost per ton to the United States is 5.5 cents, and if we consider the total outlay on all improvements since the inception of the work a century ago the cost is 6 cents per ton. It would be interesting to know what saving this 6-cent expenditure has effected. Any estimate would be little more than a guess and could not be verified. The writer has seen it stated in connection with certain localities that the saving due to better navigation facilities has been at least $1 per ton.

Appertaining to the lack of favorable results in some instances, it is frequently noted in the reports, particularly those prior to about 1880, that appropriations were very irregular and not commensurate with the character of the work to be performed. Even after the period mentioned funds were in many instances inadequate, and it appears that the work was necessarily carried on in a desultory man-

ner not calculated to produce the best or most economical results. An important item of legislation on the subject of the improvement of our waterways is contained in the river and harbor act of 1902, which provides that all projects for the improvement of rivers and harbors shall be referred to a technical board of review. Since that date practically no work has been undertaken or authorized without careful consideration of its merits, both from a commercial as well as an engineering point of view.

With regard to the number of improvements which show a decrease in commerce it seems proper to call attention to the obvious reason for this in at least some cases. These works were undertaken years ago, before the localities had the advantage of railroad facilities, and the only means of communication was by water, which was resorted to from necessity, although the water route may not have followed the natural line of trade, and navigation was difficult and expensive. It was natural under these circumstances that with the advent of the railroads much of the commerce should be diverted. It should not be forgotten, either, that in the early days when light-draft river craft carried freight and passengers long distances prices were charged accordingly, and these were very much higher than the rail rates which followed. The fact is well established that as a general proposition railroads can not compete successfully with first-class water routes. This is not true, however, in the case of inferior waterways, where distances are great and the capacity of the stream limits its use to small craft. Again, the very fact of the building of railroads often diverts the trend of commerce and causes commercial centers and traffic routes to change, and this undoubtedly accounts for the decline in trade in certain localities. It is therefore not a matter of surprise that in the general development and building up of our country some of the early established routes should show a decline in commerce in favor of others more advantageously located. This is but an incident to be expected in the general progress shown by the figures above.

*Table of detailed information on which above article is ba ed.*

| Locality | Expenditures. | Depth. | | | | Commerce. | | |
|---|---|---|---|---|---|---|---|---|
| | | Project. | Original. | Present. | Change. | Original. | Present. | Change (+ unless otherwise stated). |
| *Class No. 1.*[1] | | *Feet.* | *Feet.* | *Feet.* | *Feet.* | *Tons.* | *Tons.* | *Tons.* |
| Little Harbor | $133,227 | | | | | | | |
| Sandy Bay harbor of refuge | 1,461,172 | | | | | | | |
| Point Judith Harbor | 1,626,993 | | | | | | | |
| Duck Island Harbor | 116,309 | | | | | | | |
| New Haven (breakwaters) | 958,929 | | | | | | | |
| Glencove Harbor | 72,000 | | | | | | 7,800 | |
| Marcus Hook | 213,900 | | | | | | | |
| Delaware breakwater | 2,807,000 | | | | | | | |
| Harbor of refuge, Delaware Bay | 2,238,000 | | | | | | | |
| Harbor of refuge, Portage Lake | 376,500 | 18 | 4 | 17 | 13 | 36.000 | 3,000 | −33,000 |
| Harbor of refuge, Harbor Beach | 1,794,700 | 21 | | 19½ | | | | |
| Deep-water harbor, San Pedro | 2,514,100 | | | | | | | |
| | 14,312,830 | | | | | | | |
| *Class No. 2.*[2] | | | | | | | | |
| Bar Harbor | 206,002 | | | | | 22,000 | 47,000 | 25,000 |
| Rockland Harbor | 920,025 | 13 | 4 | 13 | 9 | 500,000 | 540,000 | 40,000 |
| Portland Harbor | 1,480,501 | 30 | 4–8–16 | 30 | 14–26 | 1,300,000 | 2,685,000 | 1,385,000 |
| Cape Porpoise Harbor | 74,064 | 15–18 | 10–13 | 15–18 | 5–5 | 20,000 | 50,000 | 30,000 |
| Gloucester Harbor | 506,845 | 10–15–30 | 3–8–25 | 10–15–30 | 7–7–5 | 80,000 | 305,000 | 225,000 |
| Scituate Harbor | 104,590 | 3–7 | 2½ | 2½ | 0 | 9,000 | 8,000 | −1,000 |
| Plymouth Harbor | 271,720 | 9 | 3 | 7½ | 6 | 27,000 | 43,000 | 16,000 |
| Provincetown Harbor | 218,661 | | | | | 12,000 | 21,000 | 9,000 |
| Burlington Harbor | 712,318 | | | | | 144,000 | 198,000 | 54,000 |
| Nantucket Harbor | 433,037 | 12–15 | 6 | 12 | 6 | 17,000 | 42,000 | 25,000 |
| Vineyard Haven | 55,387 | | | | | 12,000 | 191,000 | 179,000 |
| Block Island Harbor | 518,171 | | | | | 27,000 | 127,000 | 100,000 |
| Great Salt Pond | 191,151 | 25 | 12 | 25 | 13 | 8,000 | 55,000 | 47,000 |
| Sag Harbor | 61,900 | | | | | 35,000 | 41,000 | 6,000 |
| Grand Marais Harbor | 166,200 | 16 | 8 | 15 | 7 | 1,000 | 53,000 | 52,000 |
| Marquette Harbor | 668,700 | | | | | 1,369,000 | 3,528,000 | 2,159,000 |
| Sturgeon Bay Canal and Harbor | 600,800 | 21 | 14 | 20 | 6 | 617,000 | 699.000 | 82,000 |

[1] Number of localities, 12.

[2] Number of localities, 24. Thirteen show increased depth aggregating 125 feet, an average of 9.6 feet; 11, no data for comparison; 3 show—commerce, aggregating 3,559,000 tons; 21 show + commerce, aggregating 19,484,000 tons, a gain of 15,925,000 tons. At 3 per cent, $722,490 annually, or 1.4 cents per ton.

*Table of detailed information on which above article is based*—Continued.

| Locality. | Expenditures. | Depth. | | | | Commerce. | | |
|---|---|---|---|---|---|---|---|---|
| | | Project. | Original. | Present. | Change. | Original. | Present. | Change (+ unless otherwise stated). |
| *Class No. 2*—Continued. | | *Feet.* | *Feet.* | *Feet.* | *Feet.* | *Tons.* | *Tons.* | *Tons.* |
| Marquette harbor of refuge | $57,600 | | | 19 | | 865,000 | 1,948,000 | 1,083,000 |
| Milwaukee Harbor | 1,888,500 | 21 | 5 | 21 | 16 | 5,487,000 | 5,850,000 | 363,000 |
| Chicago Harbor | 2,056,000 | 21 | 13 | 21 | 8 | 8,461,000 | 5,126,000 | −3,335,000 |
| Cleveland Harbor | 5,351,400 | 25 | 3 | 20 | 17 | 4,248,000 | 12,179,000 | 7,931,000 |
| Buffalo Harbor | 5,268,500 | 23 | | 20 | | 10,698,000 | 16,325,000 | 5,627,000 |
| Oswego Harbor | 2,144,700 | 15 | 8 | 14 | 6 | 912,000 | 689,000 | − 223,000 |
| Cape Vincent | 127,000 | | | 19 | | 5,000 | 51,000 | 46,000 |
| | 24,083,772 | | | | | 34,876,000 | 50,801,000 | |
| *Class No. 3.*[1] | | | | | | | | |
| Sullivan Falls | 49,870 | 10 | ½ | 7½ | 7 | 46,000 | 37,000 | − 9,000 |
| Union River | 172,487 | 6 | | 6 | 6 | 54,000 | 15,000 | − 39,000 |
| Bagaduce River | 28,000 | 6 | 2 | 5 | 3 | 70,000 | 116,000 | 46,000 |
| Sasanoa River | 63,218 | 12 | 3 | 12 | 9 | 1,500 | 3,000 | 1,500 |
| Saco River | 335,730 | | 2 | 3½ | 1½ | 50,000 | 43,000 | − 7,000 |
| Cocheco River | 307,060 | 7 | 1½ | 6½ | 5 | 60,000 | 200,000 | 140,000 |
| Newburyport | 383,718 | 17 | 7 | 12½ | 5½ | 163,000 | 190,000 | 27,000 |
| Manchester River | 23,985 | 6 | | 4 | 4 | 9,000 | 6,000 | − 3,000 |
| Beverly Harbor | 26,189 | 18 | 18 | 18 | | 64,000 | 155,000 | 91,000 |
| Lynn Harbor | 259,505 | 15 | 6 | 15 | 9 | 183,000 | 355,000 | 172,000 |
| Mystic River | 28,794 | 4–6 | 2–6 | 4–6 | 2 | 14,000 | 23,000 | 9,000 |
| Malden River | 50,789 | 12 | 4 | 12 | 8 | 76,000 | 85,000 | 9,000 |
| Mystic, below Island End River | 116,189 | 25 | 14½ | 25 | 10½ | | | |
| Boston Harbor | 7,187,838 | 27–35 | 18–23–29 | 27–30 | 4–12–1 | 9,650,000 | 17,000,000 | 7,350,000 |
| Charles River | 57,500 | 7 | 4½–4 | 6 | 2 | 10,000 | 101,000 | 91,000 |
| Fort Point Channel | 70,527 | 23 | 14 | 23 | 9 | 680,000 | 1,440,000 | 760,000 |
| Weymouth Fore River | 95,784 | 18 | 15 | 18 | 3 | 68,000 | 153,000 | 85,000 |
| Weymouth Back River | 22,000 | 12 | 6 | 12 | 6 | 105,000 | 150,000 | 45,000 |
| Narrows Lake Champlain | 87,515 | 12 | 10 | 12 | 2 | 649,000 | 699,000 | 50,000 |
| Woods Hole | 263,420 | 13 | 7½ | 13 | 5½ | 12,000 | 27,000 | 15,000 |
| New Bedford | 227,919 | 25 | 12½ | 18 | 5½ | 472,000 | 985,000 | 513,000 |
| Taunton River | 193,010 | 11–12 | 5 | 11 | 6 | 488,000 | 193,000 | − 295,000 |
| Providence River | 1,851,348 | 25 | 4½ | 25 | 21½ | 1,305,000 | 3,128,000 | 1,823,000 |
| Fall River | 205,412 | 25 | 6 | 25 | 19 | 3,245,000 | 4,143,000 | 898,000 |
| Newport Harbor | 321,795 | 18 | 8 | 18 | 10 | 128,000 | 1,932,000 | 1,804,000 |
| New London Harbor | 141,080 | 23 | 17 | 23 | 6 | 700,000 | 674,000 | − 26,000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Connecticut River below Hartford | 589,193 | 10–12 | 5.7 | 10–12 | 5 | 1,041,000 | 532,000 | — 509,000 |
| Branford Harbor | 11,148 | 8½ | 6½ | 8 | 1½ | 28,000 | 27,000 | — 1,000 |
| New Haven Harbor | 631,990 | 12–20 | 5.13 | 9–19 | 5 | 2,778,000 | 1,949,000 | — 829,000 |
| West River, Conn | 38,500 | 9 | 3 | 9 | 6 | 103,000 | 126,000 | 23,000 |
| Milford Harbor | 69,170 | 6–10 | 2 | 6–10 | 7 | 11,000 | 24,000 | 13,000 |
| Housatonic River | 262,473 | 7 | 4 | 7 | 3 | 77,000 | 67,000 | — 10,000 |
| Bridgeport Harbor | 606,000 | 9–12–22 | 1–5 | 7–12–18 | 9 | 1,222,000 | 967,000 | — 255,000 |
| Norwalk Harbor | 162,000 | 6–8–10 | 1–5 | 6–10 | 5 | 340,000 | 229,000 | — 111,000 |
| Five Mile Harbor | 39,789 | 8 | 3 | 8 | 5 | 10,000 | 11,000 | 1,000 |
| Stamford Harbor | 135,000 | 7–9 | 2 | 7–9 | 6 | 31,000 | 242,000 | 211,000 |
| Greenwich Harbor | 20,500 | 6–9 | 2–4 | 6–9 | 4½ | 110,000 | 94,000 | — 16,000 |
| Port Chester | 85,900 | 9–12 | 1–4 | 9–12 | 8 | 77,000 | 277,000 | 200,000 |
| Mamaroneck Harbor | 40,000 | 4–7 | 1–5 | 4–7 | 3 | 24,000 | 39,000 | 15,000 |
| Echo Bay | 77,800 | 6 | 2 | 6 | 4 | 30,000 | 270,000 | 240,000 |
| Bronx River | 37,900 | 4 | 2 | 3 | 1 | 179,000 | 361,000 | 182,000 |
| East Chester Creek | 115,500 | 9 | 7 | 9 | 2 | 13,000 | 280,000 | 267,000 |
| Port Jefferson | 163,300 | 12 | 4 | 12 | 8 | 43,000 | 77,000 | 34,000 |
| Mattituck Harbor | 35,700 | 7 | 1–2 | 1–2 | 0 | | | |
| Huntington Harbor | 60,500 | 8 | 4 | 8 | 4 | 42,000 | 98,000 | 56,000 |
| Flushing Bay | 159,200 | 6 | 4 | 6 | 2 | 153,000 | 215,000 | 62,000 |
| Canarsie Bay | 72,700 | 4–6 | 1½–4 | 2½–6 | 2 | 32,000 | 115,000 | 83,000 |
| Harlem River | 1,467,500 | 15 | 6–10 | 15 | 17 | 3,002,000 | 9,656,000 | 6,654,000 |
| Newtown Creek | 416,100 | 18 | 4–12 | 17 | 9 | 2,740,000 | 2,955,000 | 215,000 |
| Browns Creek | 31,200 | 4 | 2 | 3 | 1 | 44,000 | 38,000 | — 6,000 |
| Great South Bay | 70,000 | 8–10 | 2–8 | 5–8½ | 2 | 93,000 | 226,000 | 133,000 |
| Saugerties Harbor | 73,500 | 12 | 7 | 10 | 3 | 151,000 | 86,000 | — 65,000 |
| Rondout Harbor | 132,500 | 14 | 7 | 13½ | 6½ | 2,467,000 | 1,192,000 | —1,275,000 |
| Peekskill Harbor | 28,200 | 10 | 5 | 9 | 4 | 490,000 | 89,000 | — 401,000 |
| Wappinger Creek | 17,500 | 8 | 6 | 7 | 1 | 52,000 | 45,000 | — 7,000 |
| Tarrytown Harbor | 22,000 | 12 | 6 | 6–12 | 3 | 71,000 | 86,000 | 15,000 |
| Coney Island Channel | 28,200 | 20 | 12½ | 12½ | | | | |
| New York Harbor | 5,506,000 | 40–30 | 16–24 | 35–30 | 19–6 | 43,500,000 | 80,000,000 | 36,500,000 |
| Gowanus Bay Channel | 2,526,000 | 40 | 7–12 | 30–35 | 23 | 3,294,000 | 4,204,000 | 910,000 |
| Arthur Kill | 341,000 | 21 | 15 | 20 | 5 | 6,879,000 | 14,414,000 | 7,535,000 |
| Channel between Staten Island and New Jersey | 308,800 | 14 | 9½ | 14 | 4½ | | | |
| Woodbridge Creek | 60,800 | 8 | 6 | 8 | 2 | 126,000 | 159,000 | 33,000 |
| Raritan Bay | 537,700 | 21 | 14 | 21 | 7 | 4,708,000 | 6,928,000 | 2,220,000 |
| Keyport Harbor | 59,500 | 8 | 3 | 7 | 4 | 210,000 | 148,000 | — 62,000 |
| Matawan Creek | 50,900 | 4 | 2 | 3 | 1 | 172,000 | 75,000 | — 97,000 |
| South River | 135,400 | 6–8 | 25–35 | 6–8 | 4 | 301,000 | 201,000 | — 100,000 |
| Elizabeth River | 51,500 | 7 | 4 | 4 | | 25,000 | 30,000 | 5,000 |
| Shoal Harbor | 45,500 | 4 | 1 | 4½ | 3½ | 48,000 | 43,000 | — 5,000 |
| Cheesequake Creek | 49,300 | 5 | 1½ | 5 | 3½ | 50,000 | 86,000 | 36,000 |
| Shrewsbury River | 363,000 | 6 | 3½ | 6 | 2½ | 568,000 | 1,718,000 | 1,150,000 |
| Manasquan River | 41,000 | 6 | 1½ | 2 | ½ | | | |
| Delaware River | 8,583,000 | 30 | 17 | 22.8 | 5.8 | 13,121,000 | 26,259,000 | 13,138,000 |
| Perriwig Bar | 48,800 | 7 | | 7 | | | | |
| Rancocas River | 44,500 | 5–6 | 4½ | 5 | ½ | 178,000 | 444,000 | 266,000 |
| Cooper Creek | 35,000 | 12 | 4 | 6–10 | 4 | 187,000 | 314,000 | 127,000 |

[1] Number of localities, 265. Two hundred and forty show increased depth aggregating 1,558 feet, or an average of 6.5 feet; 12 show no change; 13 no data; 175 show an increase in commerce aggregating 199,111,500 tons; 68 show a decrease in commerce aggregating 12,993,800 tons, a gain of 186,120,700 tons; 22 no data. At 3 per cent interest on the investment the annual cost to the United States is $5,181,237, and on the basis of present commerce is 1.5 cents per ton.

*Table of detailed information on which above article is based*—Continued.

| Locality. | Expenditures. | Depth. | | | | Commerce. | | |
|---|---|---|---|---|---|---|---|---|
| | | Project. | Original. | Present. | Change. | Original. | Present. | Change (+ unless otherwise stated). |
| *Class No. 3*—Continued. | | *Feet.* | *Feet.* | *Feet.* | *Feet.* | *Tons.* | *Tons.* | *Tons.* |
| Mantua Creek | $84,300 | 7–12 | 4½–7 | 6–10 | 2 | 147,000 | 240,000 | 93,000 |
| Raccoon Creek | 24,100 | 5–7 | 2–3 | 5–7 | 3 | 218,000 | 133,000 | — 85,000 |
| Salem River | 18,000 | 9 | 3 | 5½ | 2½ | 28,000 | 273,300 | 245,300 |
| Alloway Creek | 23,900 | 6 | 2–4 | 4½ | 1½ | 29,000 | 61,000 | 32,000 |
| Cohansey Creek | 50,100 | 7 | 4 | 6 | 2 | 16,800 | 16,000 | — 800 |
| Tuckerton Creek | 24,000 | 3–6 | 2–4 | 2–6 | 1 | 15,000 | 7,000 | — 8,000 |
| Wilmington Harbor | 969,300 | 21 | 8 | 15 | 7 | 734,000 | 853,000 | 119,000 |
| Appoquinnimink River | 41,200 | 8 | 2–4 | 4–8 | 3 | 20,000 | 32,000 | 12,000 |
| Murderkill River | 47,300 | 7 | 1 | 5 | 4 | 60,000 | 41,000 | — 19,000 |
| Mispillion River | 111,600 | 4–6 | 1 | 2½–5 | 3 | 47,000 | 202,000 | 155,000 |
| St. Jones River | 85,500 | 6 | 2 | 5 | 3 | 27,000 | 75,000 | 48,000 |
| Smyrna River | 69,000 | 7 | 2–4 | 6–7 | 3½ | 247,000 | 202,000 | — 45,000 |
| Broadkill Creek | 42,600 | 6 | 1½–3½ | 2–3 | ..... | 20,000 | 30,000 | 10,000 |
| Patapsco River | 6,282,000 | 35 | 17 | 35 | 18 | 3,243,000 | 8,441,000 | 5,198,000 |
| Curtis Bay | 236,000 | 30 | 20 | 28½ | 8½ | ..... | ..... | ..... |
| Harbor, southwest Baltimore | 320,500 | 27 | 15 | 16–27 | 7 | ..... | ..... | ..... |
| Elk River | 82,200 | 6 | 2 | 3½ | 1½ | 15,000 | 23,000 | 8,000 |
| Susquehanna River | 190,800 | 15 | 5 | 11 | 6 | 168,000 | 97,000 | — 71,000 |
| Queenstown Harbor | 39,800 | 10 | 6 | 8½ | 2½ | 35,000 | 19,000 | — 16,000 |
| Claiborne Harbor | 20 000 | 12 | 9 | 11 | 2 | 53,000 | 92,000 | 39,000 |
| Cambridge Harbor | 57,700 | 12 | 4 | 10 | 6 | 96,000 | 102,000 | 6,000 |
| Chester River | 23,000 | 6 | 3 | 5 | 2 | 3,000 | 49,000 | 46,000 |
| Choptank River | 79,100 | 8 | 2 | 6 | 4 | 13,000 | 210,000 | 107,000 |
| Warwick River | 26,000 | 10 | 4 | 9 | 5 | 50,000 | 60,000 | 10,000 |
| Pocomoke River | 35,100 | 9 | 5 | 7 | 2 | 32,000 | 66,000 | 34,000 |
| La Trappe River | 11,000 | 8–11 | 4 | 7 | 3 | 29,000 | 13,000 | — 16,000 |
| Manokin River | 31,000 | 6 | 1½ | 3½ | 2 | 144,000 | 59,000 | — 85,000 |
| Tyaskin River | 15,700 | 9 | 3½ | 8 | 4½ | 700 | 900 | 200 |
| Nanticoke River | 147,000 | 9 | 3½ | 8½ | 5 | 17,000 | 120,000 | 103,000 |
| Broad Creek | 15,100 | 8 | 1½ | 7 | 5½ | 21,000 | 27,000 | 6,000 |
| Wicomico River | 87,200 | 9 | 1½–8 | 8 | 5 | 74,000 | 200,000 | 126,000 |
| Crisfield Harbor | 37,400 | 12 | 8½ | 8½ | ..... | 30,000 | 30,000 | ..... |
| Potomac River at Washington | 2,889,200 | 20 | 10½ | 16½ | 6 | 562,000 | 861,000 | 299,000 |
| Potomac River below Washington | 185,000 | 24 | 19–23 | 24 | 2 | 1,350,000 | 1,442,000 | 92,000 |
| Anacostia River | 199,000 | 20 | 18 | 18½ | ½ | 230,000 | 287,000 | 57,000 |
| Breton Bay | 48,900 | 10 | 5 | 10 | 5 | 15,000 | 6,000 | — 9,000 |
| York River | 250,000 | 22 | 15½–18½ | 20 | 3 | 306,000 | 169,000 | — 137,000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mattaponi River | 32,000 | 5½ | 24–38 | 3 | ---------- | 38,000 | 69,000 | 31,000 |
| Pamunkey River | 27,300 | 7 | 2½–5½ | 5 | 1 | 46,000 | 40,000 | — 6,000 |
| Occoquan River | 74,100 | 6 | 1½ | 6½ | 5 | 24,000 | 53,000 | 29,000 |
| Carters Creek | 28,000 | 15 | 19½ | 15 | 4½ | 43,000 | 45,000 | 2,000 |
| Nomini Creek | 78,900 | 9 | 3 | 9 | 6 | 30,000 | 20,000 | — 10,000 |
| Rappahannock River | 399,100 | 12 | 4–6 | 8 | 3 | 116,000 | 388,000 | 272,000 |
| Urbana Creek | 43,200 | 10 | 6½ | 10 | 3½ | 14,000 | 287,000 | 273,000 |
| Milford Haven Harbor | 29,400 | 10 | 8 | 10 | 2 | 16,000 | 17,000 | 1,000 |
| James River | 2,399,400 | 22 | 7 | 16 | 9 | 699,000 | 563,000 | — 136,000 |
| Norfolk Harbor | 1,854,700 | 22–30 | 15–20 | 22–28 | 7½ | 2,180,000 | 13,406,000 | 11,226,000 |
| Western Branch, Elizabeth River | 44,700 | 20 | 12 | 19 | 7 | ---------- | ---------- | ---------- |
| Hampton Roads | 225,000 | 30 | 25 | 30 | 5 | 2,663,000 | 6,380,000 | 3,717,000 |
| Nansemond River | 87,000 | 12 | 5 | 11 | 6 | 142,000 | 108,000 | — 34,000 |
| Pagan River | 20,700 | 8 | 6½ | 10 | 3½ | 101,000 | 86,000 | — 15,000 |
| Appomattox River | 559,800 | 12 | 6½ | 8 | 1½ | 24,000 | 37,000 | 13,000 |
| Cape Charles City | 94,600 | 14–16 | 12 | 14 | 2 | 400,000 | 2,121,000 | 1,721,000 |
| Perquimans River | 13,700 | 9 | 7 | 9 | 2 | 37,000 | 88,000 | 51,000 |
| Beaufort Harbor | 174,300 | 7 | 2 | 4½ | 1½ | 56,000 | 57,000 | 1,000 |
| Beaufort Inlet | 44,800 | 20 | 12 | 16½ | 3½ | 9,000 | 12,000 | 3,000 |
| New River | 33,000 | 4 | 4 | 4 | ---------- | 5,000 | 18,000 | 13,000 |
| Cape Fear River, below Wilmington | 4,081,100 | 20 | 7½ | 20 | 12½ | 220,000 | 870,000 | 650,000 |
| Waccamaw River | 141,200 | 12 | ---------- | ---------- | ---------- | 75,000 | 248,000 | 173,000 |
| Winyah Bay | 2,442,900 | 15 | 8 | 14 | 6 | 239,000 | 379,000 | 140,000 |
| Santee River | 326,600 | 6 | 4 | 6 | 2 | 109,000 | 410,000 | 301,000 |
| Charleston Harbor | 4,641,000 | 26 | 12 | 26 | 14 | 2,528,000 | 805,000 | —1,723,000 |
| Savannah Harbor | 8,018,600 | ---------- | 9 | 22 | 13 | 2,000,000 | 3,885,000 | 1,885,000 |
| Darien Harbor | 165,400 | 12 | 6½–10½ | 10½ | 2 | 200,000 | 124,000 | — 76,000 |
| Doboy bar | 54,900 | 17 | 12 | 12 | ---------- | ---------- | ---------- | ---------- |
| Brunswick Harbor | 536,900 | 23 | 13 | 19 | 6 | 100,000 | 1,500,000 | 1,400,000 |
| Cumberland Sound | 3,290,500 | 19 | 12 | 24½ | 12½ | 244,000 | 776,000 | 532,000 |
| Fernandina Harbor | 85,000 | 20–24 | 14–18 | 21–23 | 6 | ---------- | ---------- | ---------- |
| St. Johns River | 3,660,800 | 24 | 6–12 | 24 | 13 | 567,000 | 2,115,000 | 1,548,000 |
| St. Johns River, Orange Mills flats | 118,500 | 13 | 10–11 | 13 | 2 | 106,000 | 416,000 | 310,000 |
| Volusia bar | 44,000 | 5 | 4 | 5 | 1 | 16,000 | 196,000 | 180,000 |
| Indian River | 52,400 | 5 | 4 | 5 | 1 | 10,000 | 91,000 | 81,000 |
| Biscayne Bay | 263,200 | 18 | 3 | 10 | 7 | 13,000 | 81,000 | 68,000 |
| Key West | 519,900 | 17 | 10½ | 15½ | 5 | 162,000 | 198,000 | 36,000 |
| Orange River | 4,000 | 4 | 2½ | 4 | 1½ | 3,000 | 4,000 | 1,000 |
| Caloosahatchee River | 41,100 | 4–7 | 3½–5 | 4–7 | 1½ | 10,000 | 11,000 | 1,000 |
| Sarasota Bay | 55,000 | 3–5 | 2–4 | 3–5 | 1 | 3,000 | 11,000 | 8,000 |
| Manatee River | 77,700 | 4–9 | 2–6 | 4–7 | 1½ | 16,000 | 61,000 | 45,000 |
| Tampa Bay | 566,300 | 26 | 13 | 24 | 11 | 250,000 | 775,000 | 525,000 |
| Hillsboro Bay | 765,000 | 20 | 4 | 20 | 16 | 167,000 | 425,000 | 258,000 |
| Crystal River | 23,500 | 6 | 2.7 | 2.7 | ---------- | 1,000 | 7,000 | 6,000 |
| Anclote River | 20,600 | 4–6 | 2 | 4–6 | 2 | 1,000 | 13,000 | 12,000 |
| Suwanee River | 68,600 | 6 | 1½ | 4 | 2½ | 155,000 | 25,000 | — 130,000 |
| Withlacoochee River | 55,600 | 10 | 3 | 7½ | 4½ | 3,000 | 193,000 | 190,000 |
| East Pass and Carrabelle | 80,500 | 10–20½ | 9–17 | 10–19 | 2 | 30,000 | 44,000 | 14,000 |
| Harbor at Apalachicola Bay | 348,400 | 10–18 | 3½–13 | 7–16 | 3 | 74,000 | 70,000 | — 4,000 |
| Blackwater River | 19,700 | 9 | 7 | 8 | 1 | 10,000 | 13,500 | 3,500 |
| Pensacola Harbor | 1,122,000 | 30 | 19½ | 30 | 10½ | 490,000 | 577,000 | 87,000 |
| Mobile Harbor | 5,148,000 | 23 | 8 | 23 | 15 | 1,687,000 | 2,601,000 | 914,000 |

*Table of detailed information on which above article is based*—Continued.

| Locality. | Expenditures. | Depth. | | | | Commerce. | | |
|---|---|---|---|---|---|---|---|---|
| | | Project. | Original. | Present. | Change. | Original. | Present. | Change (+ unless otherwise stated). |
| *Class No. 3*—Continued. | | *Feet.* | *Feet.* | *Feet.* | *Feet.* | *Tons.* | *Tons.* | *Tons.* |
| Mobile Bar | $124,900 | 30 | 23 | 27½ | 4½ | | | |
| Pascagoula River | 723,400 | 17 | 3–6½ | 15 | 11½ | 417,000 | 391,000 | — 26,000 |
| Horn Island | 58,300 | 21 | 18 | 21 | 3 | 110,000 | 510,000 | 400,000 |
| Biloxi Harbor | 71,000 | 8 | 4 | 9 | 5 | 104,000 | 200,000 | 96,000 |
| Gulfport | 238,600 | 19 | 10 | 19 | 9 | 97,000 | 624,000 | 527,000 |
| Wolf and Jordan rivers | 28,700 | 7 | 3 | 7 | 4 | 30,000 | 48,000 | 18,000 |
| Southwest Pass, Mississippi River | 3,974,500 | 35 | 8 | 23 | 15 | | | |
| Mouth of Calcasieu River | 611,600 | 8–12 | 3½–6½ | 6–10 | 3 | 147,000 | 321,000 | 174,000 |
| Galveston Harbor | 9,968,000 | 25–30 | 9–12 | 28 | 18 | 433,000 | 2,353,000 | 1,920,000 |
| Galveston Channel | 684,600 | | 20 | 27 | 7 | | | |
| Texas City Channel | 275,500 | 25 | 16 | 16½ | ½ | 75,000 | 77,000 | 2,000 |
| Port Bolivar | 18,700 | 25 | 8 | | | | | |
| Buffalo Bayou | 2,862,300 | 25 | 4–8 | 12 | 6 | 124,000 | 229,000 | 105,000 |
| West Galveston Bay | 138,900 | 4–6 | | | | 10,000 | 12,000 | 2,000 |
| Aransas Pass | 1,118,000 | | 8 | | | 9,000 | 15,000 | 6,000 |
| Brazos Santiago | 241,900 | | 6 | 8 | 2 | 18,000 | 7,000 | — 11,000 |
| Sabine and Neches rivers | 458,700 | 9 | 3 | 9 | 6 | 321,000 | 531,000 | 210,000 |
| Sabine Pass | 3,931,000 | 25 | 6 | 23 | 17 | 19,000 | 1,843,000 | 1,824,000 |
| Warroad Harbor | 81,700 | 7 | 3½–5 | 8 | 4 | 1,000 | 19,000 | 18,000 |
| Agate Harbor | 250,800 | | | | | 1,140,000 | 9,380,000 | 8,240,000 |
| Duluth-Superior | 5,413,400 | 20 | 9 | 20 | 11 | 3,527,000 | 28,877,000 | 25,350,000 |
| Port Wing Harbor | 46,900 | 15 | 18 | 14 | 6 | 45,000 | 59,000 | 14,000 |
| Ashland Harbor | 400,000 | 20 | | 20 | | 2,852,000 | 4,894,000 | 2,042,000 |
| Ontonagon Harbor | 377,200 | 12 | 7 | 12 | 5 | 9,000 | 29,000 | 20,000 |
| Grand Marais, Mich | 448,800 | 18 | 9 | 14 | 5 | 5,000 | 77,000 | 72,000 |
| Menominee Harbor and River | 401,900 | 20 | 5 | 18 | 13 | 752,000 | 180,000 | — 572,000 |
| Oconto Harbor | 92,600 | 9 | 4 | 7½ | 3½ | 139,000 | 45,000 | — 94,000 |
| Green Bay Harbor | 526,400 | 20 | 11 | 13–19 | 5½ | 182,000 | 1,156,000 | 974,000 |
| Sturgeon Bay Canal and Harbor | 281,700 | | | | | | | |
| Algoma Harbor | 230,500 | 16 | 3 | 12 | 9 | 39,000 | 148,000 | 109,000 |
| Kewaunee Harbor | 173,200 | 15 | 3 | 15 | 12 | 51,000 | 112,000 | 61,000 |
| Two Rivers Harbor | 264,000 | 16 | 4 | 12 | 8 | 168,000 | 115,000 | — 53,000 |
| Manitowoc Harbor | 603,100 | 20 | 4 | 20 | 16 | 197,000 | 1,777,000 | 1,580,000 |
| Sheboygan Harbor | 590,500 | 21 | 7 | 20 | 13 | 271,000 | 900,000 | 629,000 |
| Port Washington Harbor | 201,900 | 13 | 2 | 13 | 11 | 47,000 | 55,000 | 8,000 |
| Racine Harbor | 525,600 | 21 | 7 | 19 | 12 | 1,537,000 | 266,000 | — 1,271,000 |
| Kenosha Harbor | 482,900 | 21 | 4 | 19 | 15 | 56,000 | 57,000 | 1,000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Waukegan Harbor | 595,200 | 20 | 2 | 19 | 17 | 49,000 | 264,000 | 215,000 |
| Calumet Harbor | 1,456,700 | 21 | 4 | 20 | 16 | | | |
| Michigan City, outer and inner | 1,568,800 | 15 | 3½–9 | 15 | 8 | 112,000 | 82,000 | — 30,000 |
| St. Joseph Harbor | 867,400 | 15–18 | 3–16 | 16 | 4 | 493,000 | 100,000 | — 393,000 |
| South Haven Harbor | 346,300 | 16 | 7 | 12 | 5 | 347,000 | 56,000 | — 291,000 |
| Saugatuck Harbor | 458,800 | 16 | 6 | 12 | 6 | 25,000 | 11,000 | — 14,000 |
| Holland Harbor | 570,700 | 16 | 5½ | 16 | 11½ | 248,000 | 155,000 | — 93,000 |
| Grand Haven Harbor | 855,900 | 18 | 13 | 19 | 6 | 194,000 | 428,000 | 234,000 |
| Muskegon Harbor | 689,300 | 20 | 11 | 16½ | 5½ | 991,000 | 164,000 | — 827,000 |
| White Lake Harbor | 349,900 | 16 | 5 | 16 | 11 | 69,000 | 4,000 | — 65,000 |
| Pentwater Harbor | 312,400 | 16 | 4 | 15 | 11 | 101,000 | 5,000 | — 96,000 |
| Ludington Harbor | 622,800 | 18 | 8 | 18 | 10 | 316,000 | 1,496,000 | 1,180,000 |
| Manistee Harbor | 442,400 | 15 | 8 | 16 | 8 | 685,000 | 422,000 | — 263,000 |
| Frankfort Harbor | 436,700 | 18 | 4 | 18 | 14 | 48,000 | 729,000 | 681,000 |
| Charlevoix Harbor | 201,600 | 16 | 6 | 17 | 11 | 102,000 | 53,000 | — 49,000 |
| Petoskey Harbor | 125,400 | | | | | 24,000 | 121,000 | 97,000 |
| Cheboygan Harbor | 184,800 | 18 | 6 | 10–17 | 6 | 290,000 | 528,000 | 238,000 |
| Alpena Harbor | 59,600 | 16 | 12 | 16 | 4 | 348,000 | 369,000 | 21,000 |
| Saginaw Harbor | 881,000 | 12–14 | 7–9 | 12–14 | 5 | 1,591,000 | 269,000 | — 1,322,000 |
| Sebewaing River | 56,300 | 8 | 4 | 6½ | 2½ | 46,000 | 7,000 | — 39,000 |
| Mouth of Black River | 97,800 | 16 | 8 | 16 | 8 | | | |
| Rouge River | 96,300 | 21 | 10–17 | 16–17 | 3 | 200,000 | 257,000 | 57,000 |
| Monroe Harbor | 254,800 | 13–16 | 5 | 13 | 8 | 9,000 | 11,000 | 2,000 |
| Black River at Port Huron | 52,300 | 16 | 10–14 | 10–15 | 0 | 95,000 | 157,000 | 62,000 |
| Clinton River, Mich | 79,700 | 8 | 5 | 8 | 3 | 61,000 | 30,000 | — 31,000 |
| Toledo Harbor | 2,520,700 | 21 | 12–14 | 20 | 7 | 1,472,000 | 4,404,000 | 2,932,000 |
| Port Clinton Harbor | 103,900 | 10 | 5 | 11 | 6 | 14,000 | 11,000 | — 3,000 |
| Sandusky Harbor | 1,010,700 | 21 | 10 | 18–20 | 9 | 414,000 | 1,691,000 | 1,277,000 |
| Huron Harbor | 501,500 | 21 | 2 | 20 | 18 | 241,000 | 1,905,000 | 1,664,000 |
| Vermilion Harbor | 163,000 | 14 | 2 | 12 | 10 | 4,000 | 3,000 | — 1,000 |
| Lorain Harbor | 909,100 | 20 | 3 | 20 | 17 | 598,000 | 4,273,000 | 3,675,000 |
| Fairport Harbor | 795,300 | 20 | 5 | 20 | 15 | 1,082,000 | 2,859,000 | 1,777,000 |
| Ashtabula Harbor | 1,247,400 | 20 | 6 | 20 | 14 | 2,976,000 | 10,466,000 | 7,490,000 |
| Conneaut Harbor | 812,100 | 20 | 2 | 20 | 18 | 497,000 | 7,323,000 | 6,826,000 |
| Erie Harbor | 1,328,900 | 20 | 6 | 19 | 13 | 1,840,000 | 4,400,000 | 2,560,000 |
| Dunkirk Harbor | 981,400 | 16 | 10 | 16 | 6 | 9,000 | 1,000 | — 8,000 |
| Buffalo entrance to Erie Basin | 238,400 | 20 | | 20 | | | | |
| Tonawanda Harbor | 655,700 | 18 | | 15 | | 1,969,000 | 1,500,000 | — 469,000 |
| Charlotte Harbor | 714,900 | 16 | 8 | 16 | 8 | 440,000 | 576,000 | 136,000 |
| Pultneyville | 82,500 | 10 | 2 | 8 | 5 | | | |
| Great Sodus Bay | 499,000 | 15 | 8 | 14 | 6 | 58,000 | 60,000 | 2,000 |
| Little Sodus Bay | 408,200 | 15 | 2 | 13 | 11 | 99,000 | 105,000 | 6,000 |
| Ogdensburg Harbor | 361,600 | 14–15 | 9–10½ | 15–16 | 6 | 651,000 | 1,109,000 | 458,000 |
| San Diego Harbor | 655,000 | 26 | 17–21 | 27 | 9 | 162,000 | 219,000 | 57,000 |
| Wilmington Harbor | 1,501,000 | 20–24 | 2 | 20–24 | 20 | 203,000 | 1,122,000 | 919,000 |
| San Luis Obispo | 305,800 | | | | | 48,000 | 707,000 | 659,000 |
| Oakland Harbor | 2,878,300 | 12–17–25 | 2–20 | 8–20–21 | 18 | 152,000 | 1,444,000 | 1,292,000 |
| Petaluma Creek | 71,400 | 4–6 | 2 | 4 | 2 | 108,000 | 162,000 | 54,000 |
| Napa River | 37,000 | 4 | 1–5 | 4 | 1 | 81,000 | 196,000 | 115,000 |
| Humboldt Harbor | 2,179,000 | 18 | 14 | 15–22 | 8 | 177,000 | 708,000 | 531,000 |
| Coquille River | 323,900 | 8 | 3 | 10 | 7 | 21,000 | 57,000 | 36,000 |
| Coos Bay | 1,176,600 | 20 | 10 | 20 | 10 | 109,000 | 176,000 | 67,000 |

*Table of detailed information on which above article is based*—Continued.

| Locality. | Expenditures. | Depth. | | | | Commerce. | | |
|---|---|---|---|---|---|---|---|---|
| | | Project. | Original. | Present. | Change. | Original. | Present. | Change (+ unless otherwise stated). |
| *Class No. 3*—Continued. | | *Feet.* | *Feet.* | *Feet.* | *Feet.* | *Tons.* | *Tons.* | *Tons.* |
| Tillamook Bay and Bar | $128,900 | 3 | 2 | 3½ | 1½ | 19,000 | 16,000 | — 3,000 |
| Columbia River between Vancouver and mouth of Willamette | 143,000 | 20 | 9 | 15 | 6 | ..... | ..... | ..... |
| Mouth of Columbia River | 5,517,100 | ..... | 20 | 25 | 5 | ..... | ..... | ..... |
| Willapa River | 60,800 | 12 | 6 | 12 | 6 | 71,000 | 125,000 | 54,000 |
| Grays Harbor and entrance | 1,099,000 | 24 | 13 | 24 | 11 | 142,000 | 646,000 | 504,000 |
| Olympia Harbor | 139,800 | 12 | ..... | 12 | 12 | 58,000 | 79,000 | 21,000 |
| Grays Harbor, inner | 258,500 | 18 | 8 | 18 | 10 | 264,000 | 889,000 | 625,000 |
| Tacoma Harbor | 164,900 | 28–25–15 | ..... | 25 | 20 | 1,698,000 | 1,511,000 | — 187,000 |
| Waterway to Lake Washington | 468,900 | ..... | ..... | ..... | ..... | 733,000 | 796,000 | 63,000 |
| Everett Harbor | 417,500 | 26 | 10 | 26 | 16 | 113,000 | 177,000 | 64,000 |
| Swinomish Slough | 203,600 | 4 | ..... | ..... | ..... | 77,000 | 49,000 | — 28,000 |
| New Whatcom Harbor | 57,600 | 12 | 6 | 12 | 6 | 141,000 | 288,000 | 147,000 |
| | 172,707,900 | ..... | ..... | ..... | ..... | 167,465,000 | 353,585,700 | ..... |
| *Class No. 4.*[1] | | | | | | | | |
| Penobscot River | 368,908 | 11–12–22 | 6 | 11–12–22 | 5 | 840,000 | 740,000 | — 100,000 |
| Kennebec River | 542,513 | 11–15 | 3½–10 | 10–13 | 6½ | 1,140,000 | 550,000 | — 590,000 |
| Merrimac River | 371,324 | 7 | ..... | 7 | ..... | 57,000 | 86,000 | 29,000 |
| Pawtucket River | 360,282 | 16 | 5 | 12 | 7 | 192,000 | 267,000 | 75,000 |
| Pawcatuck River | 150,040 | 10 | 1½–4½ | 6–8 | 4 | 29,000 | 91,000 | 62,000 |
| Thames River | 498,461 | 14–20 | 6–13 | 14–16 | 5 | 375,000 | 444,000 | 69,000 |
| Hudson River, Troy to Coxsackie | 5,228,100 | 12 | 4–7–11 | 10–11 | 4 | 5,000,000 | 3,000,000 | —2,000,000 |
| Passaic River | 1,060,500 | 16 | 7 | 12 | 5 | 1,000,000 | 2,577,000 | 1,577,000 |
| Raritan River | 729,400 | 10 | 7½ | 10 | 2½ | 1,293,000 | 688,000 | — 605,000 |
| Roanoke River | 238,400 | 5–10 | 2½–10 | 4–8½ | 0 | 150,000 | 74,000 | — 76,000 |
| Scuppernong River | 23,500 | 9 | 5 | 9 | 4 | 43,000 | 55,000 | 12,000 |
| Trent River | 39,000 | 3 | 2 | 3 | 1 | 64,000 | 291,000 | 227,000 |
| Cape Fear River, above Wilmington | 165,700 | 3 | 1–4 | 2 | 1 | 122,000 | 137,000 | 15,000 |
| Savannah River, below Augusta | 486,600 | 5 | 3 | 3½ | ½ | 77,000 | 88,000 | 11,000 |
| Altamaha River | 161,400 | 3 | 1 | 2½ | 1½ | 100,000 | 156,000 | 56,000 |
| Oconee River | 185,700 | 3 | 1½ | 1½ | 0 | 109,000 | 105,000 | — 4,000 |
| Ocmulgee River | 337,800 | 3 | 1½ | 2½ | 1 | 115,000 | 74,000 | — 41,000 |
| Oklawaha River | 38,800 | 6 | 3 | 4 | 1 | 2,000 | 6,000 | 4,000 |
| Alabama River | 548,600 | 4 | 2½ | 3½ | 1 | 68,000 | 294,000 | 226,000 |
| Coosa River, between Rome and E. T., V. and G. R. R. | 1,074,000 | 4 | 2½ | 3 | ½ | 65,000 | 100,000 | 35,000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Coosa River, between Wetumpka and E. T., V. and G. R. R. | 400,700 | 4 | | | | | | |
| Black Warrior River | 867,900 | 6 | 1 | | | | | |
| Warrior River | 2,325,800 | 6 | 1 | 4 | 3 | | | |
| Tombigbee, mouth to Demopolis | 596,000 | 6 | | | | 49,000 | 372,000 | 323,000 |
| Tombigbee, maintenance of above | 28,900 | 6 | | | | | | |
| Bayou Lafourche | 258,000 | | | | | 195,000 | 64,000 | — 131,000 |
| Bayou Plaquemine | 1,634,000 | 10 | | | | 118,000 | 604,000 | 486,000 |
| Brazos River, Washington to Waco | 148,500 | 3½–4 | | | | | | |
| Trinity River | 310,500 | 6 | | | | 9,000 | 15,000 | 6,000 |
| Red River below Fulton | 2,390,400 | | | | | 93,000 | 121,000 | 28,000 |
| Ouachita and Black rivers | 921,100 | 6½ | | | | 160,000 | 177,000 | 17,000 |
| Big Sunflower River | 117,500 | 3 | | | | 25,000 | 158,000 | 133,000 |
| Arkansas River | 2,427,900 | | | | | 55,000 | 103,000 | 48,000 |
| Upper White River | 809,100 | 4 | | | | 23,000 | 19,000 | — 4,000 |
| Black River | 160,700 | | 2–2½ | 2½ | ½ | 110,000 | 128,000 | 18,000 |
| Mississippi River, between Ohio and Missouri | 12,376,300 | 8 | 4 | 7 | 3 | 1,119,000 | 460,000 | — 659,000 |
| Mississippi River, between Missouri and St. Paul | 11,410,600 | 6 | | 4½ | | 3,558,000 | 4,181,000 | 623,000 |
| Mississippi River, between St. Paul and Minneapolis | 1,120,400 | 6 | 2 | | | 455,000 | 300,000 | — 155,000 |
| Missouri River | 11,398,000 | | | | | 236,000 | 633,000 | 397,000 |
| Osage River | 732,900 | | | | | 90,000 | 25,000 | — 65,000 |
| Gasconade River | 109,500 | | | | | 25,000 | 35,000 | 10,000 |
| Cumberland River, below Nashville | 737,200 | 6 | | | | 47,000 | 258,000 | 211,000 |
| Cumberland River, above Nashville | 2,466,400 | | | | | 73,000 | 319,000 | 246,000 |
| Tennessee River, above Chattanooga | 594,000 | 3 | 1–2½ | 1½ | | 107,000 | 519,000 | 412,000 |
| Tennessee River, Chattanooga to Riverton | 5,556,900 | 5–6 | 2 | 2 | | 109,000 | 285,000 | 176,000 |
| Tennessee River, below Riverton | 368,000 | 5 | 2–3½ | 3 | ½ | 296,000 | 690,000 | 394,000 |
| Ohio River, open channel improvement | 6,863,000 | | | | | 7,355,000 | 11,965,000 | 4,610,000 |
| Lock 37, Ohio River | 450,500 | | | | | | | |
| Monongahela River in West Virginia | 1,751,300 | 7 | 1 | 7 | 6 | | | |
| Monongahela River in Pennsylvania | 8,957,300 | | | | | 4,407,000 | 11,143,000 | 6,736,000 |
| Allegheny River, open channel | 262,700 | | | | | 794,000 | 1,613,000 | 819,000 |
| Allegheny River, locks | 1,561,500 | | | | | | | |
| Ohio River, locks and dams, Pennsylvania | 6,293,300 | 9 | 1–2 | 9 | 7 | | | |
| Ohio River, locks between Pennsylvania and Cincinnati | 2,147,900 | | | | | | | |
| Little Kanawha River | 384,700 | 4 | | ½ | | 191,000 | 91,000 | — 100,000 |
| Kanawha River | 4,228,100 | 6 | 1 | 6 | 5 | 1,237,000 | 1,579,000 | 342,000 |
| Muskingum River | 148,700 | 6 | | 6 | | 53,000 | 79,000 | 26,000 |
| Big Sandy and Levisa River | 1,228,100 | 6 | | | | 333,000 | 182,000 | — 151,000 |
| Kentucky River | 2,927,400 | 6 | | 5½ | | 376,000 | 206,000 | — 170,000 |
| Falls of Ohio L. and P. Canal | 1,770,800 | | | | | | | |
| Wabash River lock below Vincennes | 714,900 | | | | | 53,000 | 4,000 | — 49,000 |
| Green River above Big Barren | 365,000 | | | | | 276,000 | 396,000 | 120,000 |
| Rough River | 105,400 | | | | | 74,000 | 34,000 | — 40,000 |
| Fox River | 3,195,400 | 4–6 | | 3–5 | | 332,000 | 289,000 | — 43,000 |
| Chicago River | 916,300 | 21 | 14 | 21 | 7 | 8,461,000 | 5,126,000 | —3,335,000 |
| Calumet River | 776,300 | 16–20 | 5–12 | 5–21 | 8 | 1,894,000 | 5,416,000 | 3,522,000 |
| Illinois River below Copperas Creek | 1,526,200 | 7 | | | | 39,000 | 17,000 | — 22,000 |

[1] Number of localities, 76. Thirty show increase in depth amounting to 101 feet, or an average of 3.3 feet; 46 show no change in available through depth, although many of them are improved for portions of their length; none are reported as having decreased in depth; 22 show decrease of commerce amounting to 9,817,000 tons; 43 show increase in commerce amounting to 25,036,000, a gain of 15,219,000 tons; 10 either not reported or are included in others. At 3 per cent the cost to the United States annually is $6,141,555, or 9.5 cents per ton.

*Table of detailed information on which above article is based*—Continued.

| Locality. | Expenditures. | Depth. | | | | Commerce. | | |
|---|---|---|---|---|---|---|---|---|
| | | Project. | Original. | Present. | Change. | Original. | Present. | Change (+ unless otherwise stated). |
| *Class No. 4*[1]—Continued. | | | | | | | | |
| | | *Feet.* | *Feet.* | *Feet.* | *Feet.* | *Tons.* | *Tons.* | *Tons.* |
| Grand River | 395,000 | 6 | 2 | 5 | 3 | 37,000 | 91,000 | 54,000 |
| San Joaquin River | 552,900 | 9 | 6 | 6 | ..... | 230,000 | 516,000 | 286,000 |
| Sacramento and Feather rivers | 910,400 | 3–4–7 | 1–3–4 | 2½–4–7 | 1–3 | 189,000 | 380,000 | 191,000 |
| Columbia River, between The Dalles and Celilo | 419,200 | 7 | ..... | ..... | ..... | 3,000 | 4,000 | 1,000 |
| Canal at Cascades, Columbia River | 3,819,100 | 8 | ..... | 6½ | ..... | 17,000 | 51,000 | 34,000 |
| Willamette River, above Portland | 623,700 | 3–12 | ..... | ..... | ..... | 71,000 | 373,000 | 302,000 |
| Columbia and Lower Willamette rivers | 1,769,500 | 25 | 18 | 22 | 4 | 1,613,000 | 3,680,000 | 2,067,000 |
| Clatskanie River | 12,600 | ..... | 2½ | 4 | 1½ | 127,000 | 31,000 | — 96,000 |
| Mississippi River, improvement under Mississippi River Commission | 53,508,300 | 9 | ..... | 9 | ..... | 3,200,000 | 1,819,000 | —1,381,000 |
| | 181,441,500 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Add expenditures for operating locks and dams, etc | 23,277,000 | ..... | ..... | ..... | ..... | 49,155,000 | 64,374,000 | ..... |
| | 204,718,500 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| *Class No. 5*[1] | | | | | | | | |
| Blackwater River, Virginia | 16,100 | ..... | 7 | 7 | ..... | 5,000 | 5,000 | ..... |
| Meherrin River, North Carolina | 6,500 | ..... | 7 | 7 | ..... | 9,000 | 9,000 | ..... |
| Fishing Creek | 24,900 | ..... | ..... | ..... | ..... | 1,000 | 1,000 | ..... |
| Contentnia Creek | 73,500 | ..... | ..... | ..... | ..... | 65,000 | 22,000 | — 43,000 |
| Neuse River | 346,100 | 3–8 | ..... | ..... | ..... | 282,000 | 472,000 | 190,000 |
| Northeast River | 20,700 | ..... | ..... | ..... | ..... | 35,000 | 107,000 | 72,000 |
| Black River | 21,600 | ..... | ..... | ..... | ..... | 65,000 | 57,000 | — 8,000 |
| Little Pedee River, South Carolina | 25,000 | ..... | ..... | ..... | ..... | 4,000 | 39,000 | 35,000 |
| Great Pedee River | 222,900 | 3½–9 | ..... | 2–8 | ..... | 70,000 | 184,000 | 114,000 |
| Wateree River | 101,400 | 4 | 3–4 | 3–4 | ..... | 3,000 | 31,000 | 28,000 |
| Congaree River | 326,500 | 4 | ..... | ..... | ..... | 2,000 | 47,000 | 45,000 |
| Savannah River above Augusta | 61,300 | 2 | 2 | 2 | ..... | 2,000 | 2,000 | ..... |
| Kissimmee River, Florida | 24,000 | 3 | 2 | 3 | 1 | 7,000 | 7,000 | ..... |
| Apalachicola River | 96,500 | 5–6 | ..... | ..... | ..... | 27,000 | 110,000 | 83,000 |
| Upper Chipola River | 16,400 | ..... | 2–5 | ..... | ..... | 11,000 | 11,000 | ..... |
| Flint River | 271,300 | 3 | 3 | 3 | ..... | 6,000 | 12,000 | 6,000 |
| Chattahoochee River | 641,700 | 4 | 3 | 3 | ..... | ..... | ..... | ..... |
| Choctawhatchee River | 182,400 | ..... | ..... | ..... | ..... | 44,000 | 24,000 | — 20,000 |
| Holmes River | 13,100 | ..... | ..... | ..... | ..... | 5,000 | 5,000 | ..... |
| Escambia River | 135,500 | 5½ | ..... | ..... | ..... | ..... | ..... | ..... |
| Tombigbee River | 172,000 | 6 | 1 | 2 | 1 | 18,000 | 9,000 | — 9,000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Tombigbee River, Columbus to Walkers Bridge | 76,600 | | | | | 136,000 | 15,000 | — 121,000 |
| Pascagoula River, upper | 38,300 | | | | | 145,000 | 252,000 | 107,000 |
| Leaf River | 22,000 | | 2½ | | | 79,000 | 188,000 | 109,000 |
| Chickasahay River | 24,800 | | ½ | | | 13,000 | 133,000 | 120,000 |
| Pearl River below Rockport | 176,300 | 5 | | | | 129,000 | 43,000 | — 86,000 |
| Pearl River between Edinburg and Jackson | 63,800 | | | | | | | |
| Bayou Teche | 95,900 | 6 | | 4 | | 68,000 | 662,000 | 594,000 |
| Homochitto River | 17,700 | | | | | 3,000 | 65,000 | 62,000 |
| Boguo Chitto | 27,800 | | | | | 19,000 | 49,000 | 30,000 |
| Chefuncte River | 12,500 | | | | | 40,000 | 226,000 | 186,000 |
| Tickfaw River | 14,100 | | | | | 9,000 | 41,000 | 32,000 |
| Amite River | 42,300 | | | | | 52,000 | 46,000 | — 6,000 |
| Mermentau River | 27,800 | | | | | 12,000 | 50,000 | 38,000 |
| Brazos River, Velasco to Old Washington | 195,700 | | | | | | | |
| Cypress Bayou, Texas | 139,400 | | | | | 1,000 | 5,000 | 4,000 |
| Red River | 162,600 | | | | | 2,000 | 39,000 | 37,000 |
| Sulphur River | 10,600 | | | | | | | |
| Bayou Bartholomew | 64,900 | | | | | 28,000 | 2,000 | — 26,000 |
| Boeuf River | 64,900 | | | | | 4,000 | 2,000 | — 2,000 |
| Tensas River | 54,500 | | | | | 16,000 | 15,000 | — 1,000 |
| Bayou D'Arbonne | 23,900 | | | | | 10,000 | 10,000 | |
| Yazoo River, Mississippi | 372,000 | | | 3½ | | 85,000 | 122,000 | 37,000 |
| Tallahatchie River | 79,000 | | | | | 50,000 | 47,000 | — 3,000 |
| Tallahatchie River, above Coldwater River | 13,800 | | | | | | | |
| Tchula Lake | 28,700 | | | | | 8,000 | 1,000 | — 7,000 |
| White River | 440,900 | | | | | 64,000 | 129,000 | 65,000 |
| Current River | 39,900 | | | | | 25,000 | 40,000 | 15,000 |
| St. Francis River | 108,400 | | | | | 41,000 | 191,000 | 150,000 |
| St. Croix River | 146,900 | 3 | 2 | 2 | | 944,000 | 647,000 | — 297,000 |
| Minnesota River | 135,600 | | 2 | 2 | | 3,000 | 3,000 | |
| Red River of the North | 333,700 | 3–4 | 1–2 | | | 9,000 | 14,000 | 5,000 |
| French Broad River | 96,300 | 2½ | 1½ | | | 37,000 | 136,000 | 99,000 |
| Clinch River | 54,300 | 1½ | | | | | | |
| Hiwassee River | 67,000 | 2½ | | 2 | | 11,000 | 6,000 | — 5,000 |
| Wabash River, above Vincennes | 95,200 | | | | | | | |
| White River, Indiana | 119,300 | | | | | 12,000 | 9,000 | — 3,000 |
| Mokelumne River, California | 20,300 | | | | | 39,000 | 17,000 | — 22,000 |
| Coos River, Oregon | 14,300 | | | | | 17,000 | 40,000 | 23,000 |
| Snake River | 258,100 | | 2 | 3 | 1 | 23,000 | 48,000 | 25,000 |
| Columbia River | 154,000 | | | | | 23,000 | 48,000 | 25,000 |
| Cowlitz River, Washington | 51,200 | | | | | 250,000 | 306,000 | 56,000 |
| Lewis River | 19,600 | | | | | 3,000 | 21,000 | 18,000 |
| Puget Sound and tributaries | 316,200 | | | | | 60,000 | 125,000 | 65,000 |
| Columbia River between Wenatchee and Bridgeport | 30,000 | | | | | 24,000 | 42,000 | 18,000 |
| Okanogan River | 38,000 | | | | | 1,000 | 1,000 | |
| Pend Oreille River | 22,400 | | | | | 5,000 | 29,000 | 24,000 |
| | 7,200,900 | | | | | 3,161,000 | 5,019,000 | |

[1] Number of localities, 67. Two only show actual results in channel dimensions, an increase of 1 foot each in depth; 33 show an increase in commerce aggregating 2,517,000 tons; 16 show a decreas3 in commerce aggregating 659,000 tons—gain, 1,858,000 tons; 8 show no change; 10 no data. Cost to United States at 3 per cent, $216,027 annually, or 4.3 cents per ton on present commerce.

*Table of detailed information on which above article is based*—Continued.

| Locality. | Expenditures. | Depth. | | | | Commerce. | | |
|---|---|---|---|---|---|---|---|---|
| | | Project. | Original. | Present. | Change. | Original. | Present. | Change (+ unless otherwise stated). |
| *Class No. 6.*[1] | | *Feet.* | *Feet.* | *Feet.* | *Feet.* | *Tons.* | *Tons.* | *Tons.* |
| Waterway, Norfolk to sounds of Carolina, via Dismal Swamp Canal | $251,200 | 10 | 6 | 10 | 4 | 77,000 | 377,000 | 300,000 |
| Waterway, Norfolk to sounds of Carolina, via A. and C. Canal | 302,200 | 9 | 5 | 9 | 4 | 337,000 | 125,000 | 212,000 |
| Inside waterway, Savannah to Fernandina | 110,500 | 7 | ..... | ..... | ..... | 323,000 | 273,000 | 50,000 |
| Inland waterway, Franklin to Mermentau | 6,900 | 5 | ..... | ..... | ..... | ..... | ..... | ..... |
| Keweenaw Canal | 1,335,700 | 20 | 13 | 20 | 7 | 594,000 | 2,497,000 | 1,903,000 |
| Black Rock Harbor | 230,600 | 23 | ..... | 8 | ..... | ..... | ..... | ..... |
| Illinois and Mississippi Canal | 7,319,500 | 7 | ..... | ..... | ..... | ..... | ..... | ..... |
| *Class No. 7.*[2] | 9,556,600 | ..... | ..... | ..... | ..... | 1,331,000 | 3,272,000 | ..... |
| Lubec Channel, Me | 307,432 | 12 | 5 | 11½ | 6½ | 52,000 | 85,000 | 33,000 |
| East River and Hell Gate | 4,833,800 | 26 | ..... | 26 | ..... | ..... | ..... | ..... |
| St. Johns River, opposite Jacksonville | 112,300 | 24 | ..... | ..... | ..... | ..... | ..... | ..... |
| Closing Pass a Loutre | 250,000 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Surveys of South Pass | 412,200 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Mouth of Yazoo River and Vicksburg Harbor | 2,011,400 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Mississippi River between Missouri River and St. Paul | 1,058,000 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Mississippi River at Moline | 369,900 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Reservoirs, head of Mississippi River | 1,429,700 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Harbor at Pittsburg | 147,700 | 10 | 3–4 | 10 | 6 | 8,651,000 | 13,197,000 | 4,546,000 |
| San Pablo Bay | 332,000 | 30 | 19 | 22 | 3 | ..... | ..... | ..... |
| *Class No. 8.* | 11,264,432 | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| Hay Lake and Neebish Channel | 7,172,400 | 21 | 5 | 21 | 16 | ..... | ..... | ..... |
| St. Marys Canal | 7,427,000 | 20 | 12 | 20 | 8 | 1,954,000 | 51,412,000 | 49,458,000 |
| Detroit River | 4,210,000 | 21–22 | 14 | 21 | 7 | 23,815,000 | 63,514,000 | 39,699,000 |
| Connecting channels | 3,338,000 | 20 | 10 | 20 | 10 | ..... | ..... | ..... |
| St. Clair River | 2,951,200 | 20 | 6 | 20 | 14 | ..... | 66,272,000 | ..... |
| | 25,198,600 | | | | | [3] 25,000,000 | [3] 75,000,000 | [1] 50,000,000 |

[1] Number of localities, 7. Three show increase of depth of 15 feet, an average of 5 feet; 4 no data; gain in commerce, 1,941,000 tons. At 3 per cent interest, the cost to the United States is $298,698 annually, or 9.1 cents per ton of present commerce.

[2] Number of localities, 11.

[3] About.

NOTE.—Generally speaking, the same commerce applies to each of these several improvements, although no single one represents the total, as there is some commerce that does not pass through each.

DOCUMENT No. 16 | NATIONAL WATERWAYS COMMISSION | 1910

# RAILWAY FREIGHT RATES INLAND WATERWAYS AND CANALS IN FRANCE

REPORT BY

FRANK H. MASON

AMERICAN CONSUL-GENERAL AT PARIS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1910

## NATIONAL WATERWAYS COMMISSION.

OF THE SENATE.

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# RAILWAY FREIGHT RATES, INLAND WATERWAYS, AND CANALS IN FRANCE.

By Frank H. Mason,

*American Consul-General at Paris.*

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The following report was submitted in answer to questions prepared by the National Waterways Commission and the Department of Commerce and Labor:

## Chapter I.

### QUESTIONS RELATING TO FOREIGN RAILWAY RATES SUBMITTED BY THE NATIONAL WATERWAYS COMMISSION THROUGH THE DEPARTMENT OF STATE.

I. Give ten examples of rates on coal on different railway lines for different distances, with the following details:

(*a*) Give termini for each shipment.

(*b*) Give distances of each shipment, including in the list of ten rates at least three rates for the maximum distance that coal is shipped.

(*c*) Give separately the terminal and transportation charge. (If this is not possible, make note of the fact that the two are combined.)

(*d*) State what service is covered by the terminal charge.

(*e*) State the class of rate into which the coal traffic falls; that is, whether the rate is a special or commodity rate or a normal class rate, and if the latter, what class.

(*f*) Give all other facts concerning method of shipment which affect the rate, such, for example, as minimum carload weight or minimum train load, open or closed cars, fast or slow freight, and the like.

(*g*) If any of these rates have been given to encourage the development of any industry, state the facts.

II. Answer the above seven questions (*a* to *g*), quoting in each case ten examples of rates on different railway lines for different distances for the following commodities:

1. Iron ore.
2. Stone.
3. Lumber.
4. Fertilizers.
5. Grain.

III. Give ten illustrations of special rates granted to export business on different railways for different distances, and answer in each case the questions propounded above for the coal traffic (*a* to *g*) so far as they are applicable to the export business. Make a statistical tabulation comparing these export rates with local rates between the same termini.

IV. Give ten illustrations of rates charged by different railways for different distances on the highest grade of classified freight, that which, in many countries, corresponds to the express business of the United States, and answer in each case the questions propounded for the coal traffic (*a* to *g*).

V. Give ten illustrations of rates charged by different railways for different distances on typical products included in the various categories of the regular freight classification, showing both carload and less than carload rates, and answer in each case the questions propounded for the coal traffic (*a* to *g*).

VI. Are the freight rates based absolutely on distance, or is the rate per ton-mile less for longer distances? Show, in the case of different commodities, at what distances the fall in the rate per ton-mile takes place.

## Chapter II.

### QUESTIONS SUBMITTED BY THE DEPARTMENT OF COMMERCE AND LABOR THROUGH THE DEPARTMENT OF STATE RELATIVE TO RIVERS AND CANALS IN FOREIGN COUNTRIES.

#### I.—PUBLIC SUPERVISION.

(*a*) State what public authority, national, state, or local, exercises supervision in the different instances over navigable streams and canals.

(*b*) What are the powers and duties of such officials in regard to the following:

(3) Capitalization of navigation corporations.
Regulation of freight rates.
Reports of operation.
Maintenance and improvement of channels, docks, and terminal facilities.

(4) Collection of statistics of water-borne traffic, and by what agencies such statistics are compiled and published.

#### II.—WATERWAY IMPROVEMENTS.

(*a*) Is there any established policy as to water powers developed by works constructed for improving navigation? Give illustrations.

(*d*) To what general extent have river improvements and the construction of canals been carried on by the central government, by local governments, and by private enterprise? Give typical and important illustrations of each. Describe any system of cooperation and contribution between the central government and local government in such works.

#### III.—FLOATING EQUIPMENT.

(*a*) What is the general character of vessels used on rivers and canals?

(1) The relative use of self-propelled vessels and towed vessels.

(2) Motive power for barges and canal boats.

(3) Size and draft of vessels.

(4) The use of iron, steel, and wood in vessel construction.

(5) The cost of various types of boats.

(6) The use of special types of boats for particular cargoes and on different classes of waterways.

(7) The size of fleets of barges.

(8) Is the type of boats adapted to low-water stages, or are they constructed with a view to utilization in high water?

In each case specific information is desired showing the situation in typical instances rather than general statements of a summary character.

#### IV.—OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

(*a*) Do canal companies or other waterway improvement companies own and operate vessels? Give examples.

(*c*) Are there important cases of consolidation of vessel owners into large corporations operating extensive fleets on inland waterways?

(*d*) To what extent are vessels owned and operated by railroads, or by producing and distributing concerns, such as coal, oil, lumber, ore, etc., fleets? Give examples.

(*e*) Are there any fleets of merchant vessels owned and operated by public authorities? Give examples.

(*g*) Are there important instances of combinations or monopolies controlling towing on canals and rivers? Give examples.

#### V.—TERMINAL FACILITIES.

(*a*) What are the important or striking physical features of river and canal terminals, such as docks, wharves, piers, and floating wharf boats? Give illustrations and send photographs with this answer.

(*b*) Describe the most advanced methods of loading and unloading vessels on inland waterways, including the use of mechanical appliances.

(*d*) Are railroad tracks located on terminals of inland waterways, permitting direct transfer between railroad and water lines? Do such railroad tracks form a belt railroad, connecting all the railroads at a given port? Give examples.

(*e*) Are river and canal terminals owned by public or private interests? Are they owned at all by private railways? If so, give the important instances.

### VI.—TOLLS AND FREIGHT RATES.

(*a*) Are tolls charged on canals and rivers? If so, what elements are considered in framing them and what service do they cover? Are there separate tolls for boats and cargo? Give typical illustrations.

(*b*) What elements enter into the making of towing rates on canals and rivers? Give illustrations of towing charges and send copies of any tariffs or towing rates.

(*c*) Do inland water lines have regular schedules of freight rates and classifications of freight? Are the rates stable or do they vary frequently with traffic exigencies? Give illustrations.

(*d*) How are inland waterway rates affected by—

(1) Distance of haul?
(2) Quantity of commodity offered?
(3) Speed?
(4) Character of commodity?

Give illustrations on important waterways.

(*e*) Do prorating arrangements exist between water lines and railroads, and to what extent? Give illustrations and send copies of joint rail and water tariffs.

(*f*) How do inland water rates affect railroad freight rates? Are railroad freight rates to water competitive points higher than to interior nonwater points of similar distances? Give illustrations.

Compare inland water rates with paralleling railway rates for short and for long distances, giving specific illustrations which shall show whether waterways have greater competitive power in the one case than in the other.

(*g*) What is the general attitude of rail and water lines toward each other? Is there active competition or are there agreements for the division of traffic? Give examples.

(*h*) Is there any legislation regulating the relations between rail and inland waterway systems of transportation? Is there any governmental restriction on the lowering of rail rates in competition with water rates? Give examples.

(*j*) Is it customary for shippers of goods by inland waterways to insure them, or is the risk assumed by the carrier? To what extent does this affect the freight rate? Give examples.

### VII.—WATER-BORNE TRAFFIC.

(*a*) What is the general character of traffic on inland waterways: The principal commodities moved, the proportion and character of traffic moved in different directions, relative importance of package and bulk freight, etc. (This should be answered specifically for different waterways.)

(*b*) Send official publications giving, for the last ten years, available statistics of vessel movement and traffic carried on inland waterways; also railroad traffic, tonnage, and ton-mileage.

(*c*) Taking important inland water routes, does local traffic or other traffic predominate, and in what general proportion?

(*d*) Give a concise statement of typical conditions of labor which is employed in navigation and in terminal handling, particularly with reference to wages paid.

NOTE.—The above questions were revised by the members of the National Waterways Commission.

## Chapter I.

### RAILWAY FREIGHT RATES.

The railway service of France comprises substantially seven different groups or systems, two of which are owned and operated by the National Government, while five are owned and managed by corporations, or stock companies, similar in most respects to chartered railway companies in the United States.

The state railway systems are known, respectively, as the "Réseau d'Etat," which operates a main line from the Montparnasse station in Paris, southwestward to Bordeaux, with a network of branch lines extending to Angers, Poitiers, Nantes, La Rochelle, Angoulême, and other points, a total length of 1,854 miles, of which 84.5 miles are tracks used in common with the Orléans Railway Company.

The second and principal state railroad system is the Western Railway, with lines radiating from Paris west and northwestwardly to Dieppe, Havre, Cherbourg, Brest, and other seaports, which were built and operated for many years by a chartered corporation until purchased and taken over by the state, under the act of July 13, 1908, on the 1st of January, 1909.

The other great units of the French system, viz, the Northern, Eastern, Orléans, Midi, and Paris-Lyon and Mediterranean railway companies are private corporations, chartered by the state under conditions which render them subject to government control in many details of rates and management.

The field or territory covered by each of these systems is called technically its "réseau," which for want of a precise synonym in English will be used in that sense throughout this report. The réseau of each of the seven connecting systems above described—and which collectively cover practically the whole of France—is clearly shown by a map entitled "Carte Générale des Chemins de Fer de la France," published by La Librairie Chaix.

The names of the several systems, the number of kilometers and miles of track in operation by each at the end of December, 1908, and the gross earnings per kilometer and mile during the year are shown in the following table:

| | Total length. | | Gross earnings. | | Earnings per— | |
|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | | | Kilometer. | Mile. |
| | | | *Francs.* | | *Francs.* | |
| Réseau of the state | 2,967 | 1,854 | 58,740,566 | $11,336,929 | 19,798 | $6,114 |
| Western, now state | 5,965 | 3,728 | 216,350,717 | 41,755,688 | 35,342 | 11,200 |
| Northern | 3,780 | 2,362 | 269,851,039 | 52,481,250 | 70,362 | 22,214 |
| Eastern | 4,901 | 3,063 | 230,315,058 | 44,450,806 | 46,706 | 14,512 |
| Orléans | 7,750 | 4,862 | 276,847,322 | 53,431,533 | 34,960 | 10,990 |
| Midi R. R | 3,851 | 2,406 | 130,572,260 | 25,200,446 | 52,005 | 10,474 |
| P. L. M | 9,520 | 5,950 | 512,116,366 | 98,828,459 | 54,041 | 16,946 |
| Total | 38,734 | 24,225 | | | | |

Besides these, there are at Paris two local military railways, known as the "Ceinture" and the "Grand Ceinture," respectively. The first of these encircles the city inside the fortifications, and has a total length of 20 miles, while the second, with a length of 78 miles, forms a belt around Paris at a distance of about 10 miles outside the city limits. Both "Ceinture" railways carry passengers and some local freight, but are of relatively small importance, except for military purposes.

Finally, there are in France a few local railways belonging to private companies, whose lines aggregate in length 672 miles, and earned in 1908 a gross income of $2,383,877. But, like the "Ceinture," or belt line at Paris, they form no essential part of the general railway system for large freight traffic, and are therefore omitted henceforth from the scope of this report.

## METHODS OF FREIGHT CLASSIFICATION.

The system of classification and the schedules of rates for the transportation of freight by rail in France are more complicated and difficult in application than those of any other country. Freights are of two general designations, viz, express or fast freights (Grande vitesse), and ordinary or slow freights (Petite vitesse), which correspond to the usual character of heavy, coarse freights in the United States.

The rates under each of these categories vary in accordance with the nature of the merchandise, length of haul, the quantity transported in each shipment, and other more or less changeable conditions, so that, besides the general tariff, which is practically uniform on the various lines, there are numerous variations in the form of special tariffs, which apply under certain circumstances, as, for example, the "Export Schedule," which is granted on merchandise carried not less than a prescribed distance by a French railway on the way to a seaport for shipment abroad.

The schedule of rates for slow, ordinary freights with the necessary instructions and the long list of special tariffs for various merchandise on the different railway systems, fill a volume known as the "Réceuil Chaix," which is 10 by 14 inches in size and contains 1,720 closely printed pages that resemble a table of logarithms. The book of express, or fast freight schedules, is of the same size, but contains only 994 pages. Both are issued by the same publisher and the changes, in the form of additions, modifications, and suppressions are so frequent that a new edition of each is issued about every three months. All references hereinafter made to chapters, or special tariffs with distinctive numbers, relate to and will be found in one or the other of these publications, which form the chart or working handbooks of French railway transportation.

The system is so complicated that merchants, manufacturers, and other firms which ship largely by rail either do so through professional "expéditeurs" or forwarding houses, or must employ expert clerks whose special duty it is to estimate classifications, rates, and rebates for each transaction. Not only this, but there are in Paris special firms of "gleaners," similar to chartered accountants, whose business it is to take over and revise the paid freight bills of mercantile shippers, and, for a compensation of half the amount recovered, audit such accounts and reclaim from the railways rebates on overcharges, where excessive freight charges have been collected. French law requires that when freight passes through or into the "Réseaux" of

two or more railway systems it shall be carried by the most direct route between the point of departure and destination. If, as frequently happens, the car which carries it makes a detour, the rate collected for such extra distance constitutes an overcharge, which can be recovered by protest or legal process. What still more frequently happens is that the shipper, through lack of expert knowledge, pays the general or standard freight on goods which, under existing conditions, are entitled to be transported under one of the many special tariffs, and such errors it is the business of the auditing "gleaners" to detect, and claim restitution of the overpaid charges

## THE BASIS OF RAILWAY FREIGHT RATES IN FRANCE.

### (1) FAST-FREIGHT RATES.

Tariff rates for express or fast-freight transportation are applied on all the great systems above described, namely, the State, Western, Northern, Eastern, Orléans, Southern, and Paris, Lyon and Mediterranean railways, as well as on the belt lines about Paris.

These rates are established on a basis per ton-kilometer, which decreases as the length of haul exceeds one or more hundred kilometers up to 1,000 kilometers, or 683 miles. The units of weight used in all the tables of this report are either the metric ton of 1,000 kilograms, equal to 2,204.6 pounds avoirdupois, or fractions of the same in metric quintals, or 100 kilograms, equal to 220 pounds.

The rate schedule per ton for fast freight is as follows:

Up to and including 100 kilometers (62 miles), 0.335 francs ($0.064) per kilometer, or 33.50 francs per 100 kilometers ($6.46).

From 100 to 200 kilometers (62 to 124 miles), 0.315 francs ($0.06) per kilometer, or 93.50 francs ($18.04) for 300 kilometers (186 miles).

From 300 to 500 kilometers (186 to 311 miles), 0.295 francs ($0.056) per kilometer, or 149.50 francs ($28.85) for 500 kilometers (311 miles).

From 600 to 700 kilometers (373 to 435 miles), 0.255 francs ($0.049) per kilometer, or 199.50 francs ($38.50) for 700 kilometers (435 miles).

From 700 to 800 kilometers (435 to 497 miles) 0.235 francs ($0.045) per kilometer, or 221.50 francs ($42.75) for 800 kilometers (497 miles).

From 800 to 900 kilometers (497 to 559 miles), 0.215 francs, ($0.041) per kilometer, or 241.50 francs ($46.61) for 900 kilometers (559 miles).

From 900 to 1,000 kilometers (559 to 621 miles) 0.195 francs ($0.037) per kilometer, or 259.50 francs ($40.08) per 1,000 kilometers (621 miles).

From 1,000 to 1,100 kilometers (621 to 683 miles) 0.175 francs ($0.03) per kilometer, or 275.50 francs ($53.17) for 1,100 kilometers (683 miles).

Over 1,100 kilometers (683 miles) 0.155 francs ($0.029) per kilometer, or 275.65 francs ($53.20) for 1,101 kilometers (684 miles).

For any number of kilometers in excess of 1,101 the rate is $0.02 per kilometer.

In the above examples there is included in each case the sum of 1.50 francs per ton ($0.28) as charges for loading and unloading.

There exist other tariff rates much lower for shipments of articles of food, such as butter, liquids, vegetables, meat, cheese, fruits, lard, fish, milk, eggs, wine in vats or barrels, charcuterie, and dressed poultry.

For such merchandise the rate is from 0.24 francs ($0.04) per kilometer up to 100 kilograms (62 miles) to 0.105 francs ($0.02) per kilometer up to 100 kilometers (683 miles). The charges for loading and unloading of $0.28 must be added as in the examples above.

### (2) SLOW-FREIGHT RATES.

This class of freight falls under the maximum tariff fixed by the Cahier des Charges (petite vitesse).

*General tariff.*—Merchandise is classified in this tariff under four classes:

First class, 0.16 francs ($0.03) per ton per kilometer.
Second class, 0.14 francs ($0.02) per ton per kilometer.
Third class, 0.10 francs ($0.019) per ton per kilometer.
Fourth class, 0.08 francs ($0.01) from 1 kilometer to 100 kilometers (62 miles), on condition that the freight charges exceed 5 francs ($0.96).
Fourth class, 0.05 francs ($0.009) per ton-kilometer from 101 to 300 kilometers (62.7 to 186 miles), on condition that the freight charges on the shipment exceed 12 francs ($2.31).
Fourth class, for distances exceeding 300 kilometers (186 miles) the rate is 0.04 francs ($0.007) per ton and per kilometer.

The seven large railway companies have established six classes of freights, including the four given above, to which are applied the following tariff tables, according to the conditions of each shipment and the quantity of merchandise to be hauled.

To these six classes of the general tariff, the details of which are given below, must be added the charges of loading and unloading of 1.50 francs ($0.28) per ton and the terminal charges of 1 franc ($0.19) per 4 tons.

EASTERN RAILWAY (CHEMIN DE FER DE L'EST.)

| | First class. | | Second class. | | Third class. | | Fourth class. | | Fifth class. | | Sixth class. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Francs. | U. S. currency. | Francs. | U. S. currency. | Francs. | U. S. currency. | Francs. | U. S. currency. | Francs. | U. S. currency. | Francs. | U. S. currency. |
| Per 100 kilometers (62 miles) | 16.00 | $3.08 | 14.00 | $2.70 | 11.00 | $2.12 | 10.00 | $1.93 | 8.00 | $1.54 | 5.00 | $0.96 |
| Per 300 kilometers (186 miles) | 46.00 | 8.88 | 40.00 | 7.72 | 31.00 | 5.98 | 28.00 | 5.40 | 19.50 | 3.76 | 12.00 | 2.31 |
| Per 500 kilometers (311 miles) | 74.00 | 14.28 | 64.00 | 12.35 | 49.00 | 9.45 | 44.00 | 8.49 | 27.50 | 5.31 | 18.00 | 3.47 |

STATE RAILWAY (CHEMIN DE FER DE L'ÉTAT.)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Per 100 kilometers (62 miles) | 15.00 | $2.89 | 13.00 | $2.51 | 11.50 | $2.22 | 9.50 | $1.83 | 6.00 | $1.15 | 5.00 | $0.96 |
| Per 300 kilometers (186 miles) | 39.00 | 7.52 | 33.00 | 6.37 | 30.00 | 5.79 | 24.00 | 4.63 | 15.00 | 2.89 | 12.00 | 2.31 |
| Per 500 kilometers (311 miles) | 65.00 | 12.54 | 55.00 | 10.61 | 50.00 | 9.65 | 40.00 | 7.72 | 25.00 | 4.82 | 20.00 | 3.86 |
| Per 500 kilometers (311 miles) | 52.00 | 10.03 | 44.00 | 8.49 | 40.00 | 7.72 | 32.00 | 6.17 | 20.00 | 3.86 | 16.00 | 3.08 |

SOUTHERN RAILWAY (CHEMIN DE FER DU MIDI).

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Per 100 kilometers (62 miles) | 16.00 | $3.08 | 14.00 | $2.70 | 13.00 | $2.51 | 12.00 | $2.31 | 10.00 | $1.93 | 5.00 | $0.96 |
| Per 300 kilometers (186 miles) | 48.00 | 9.26 | 42.00 | 8.10 | 38.50 | 7.43 | 35.00 | 6.75 | 26.50 | 5.11 | 12.00 | 2.31 |
| Per 500 kilometers (311 miles) | 78.00 | 15.05 | 67.00 | 12.93 | 60.00 | 11.58 | 61.00 | 11.77 | 38.50 | 7.43 | 18.00 | 3.47 |

NORTHERN RAILWAY (CHEMIN DE FER DU NORD).

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Per 100 kilometers (62 miles) | 16.00 | $3.08 | 14.00 | $2.70 | 12.00 | $2.31 | 10.00 | $1.93 | 8.00 | $1.54 | 5.00 | $0.96 |
| Per 200 kilometers (124 miles) | 31.00 | 5.98 | 27.00 | 5.21 | 23.00 | 4.44 | 19.00 | 3.66 | 15.00 | 2.89 | 8.50 | 1.64 |
| Per 300 kilometers (186 miles) | 46.00 | 8.88 | 39.00 | 7.52 | 33.00 | 6.37 | 27.00 | 5.21 | 31.00 | 5.98 | 12.00 | 2.31 |

ORLÉANS RAILWAY (CHEMIN DE FER D'ORLÉANS).

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Per 100 kilometers (62 miles) | 16.00 | $3.08 | 14.00 | $2.70 | 12.00 | $2.31 | 10.00 | $1.93 | 8.00 | $1.54 | 5.00 | $0.96 |
| Per 300 kilometers (186 miles) | 46.00 | 8.88 | 40.00 | 7.72 | 34.00 | 6.56 | 28.00 | 5.40 | 22.00 | 4.24 | 12.00 | 2.31 |
| Per 500 kilometers (311 miles) | 74.00 | 14.28 | 64.00 | 12.35 | 54.00 | 10.42 | 44.00 | 8.49 | 34.00 | 6.56 | 18.00 | 3.47 |

WESTERN RAILWAY (CHEMIN DE FER DE L'OUEST).

| | First class. | | Second class. | | Third class. | | Fourth class. | | Fifth class. | | Sixth class. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Francs. | U. S. currency. | Francs. | U. S. currency. | Francs. | U. S. currency. | Francs. | U. S. currency. | Francs. | U. S. currency. | Francs. | U. S. currency. |
| Per 100 kilometers (62 miles) | 16.00 | $3.08 | 14.00 | $2.70 | 12.00 | $2.31 | 10.00 | $1.93 | 8.00 | $1.54 | 5.00 | $0.96 |
| Per 300 kilometers (186 miles) | 46.00 | 8.88 | 40.00 | 7.72 | 34.00 | 6.56 | 28.00 | 5.40 | 22.00 | 4.24 | 12.00 | 2.31 |
| Per 500 kilometers (311 miles) | 72.00 | 13.89 | 62.00 | 11.96 | 52.00 | 10.03 | 42.00 | 8.10 | 33.00 | 6.37 | 18.00 | 3.47 |

PARIS, LYON AND MEDITERRANEAN RAILWAY

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Per 100 kilometers (62 miles) | 16.00 | $3.08 | 14.00 | $2.70 | 12.00 | $2.31 | 10.00 | $1.93 | 8.00 | $1.54 | 5.00 | $0.96 |
| Per 300 kilometers (186 miles) | 46.00 | 8.88 | 40.00 | 7.72 | 34.00 | 6.56 | 28.00 | 5.40 | 19.50 | 3.76 | 12.00 | 2.31 |
| Per 500 kilometers (311 miles) | 74.00 | 14.28 | 64.00 | 12.35 | 54.00 | 10.42 | 44.00 | 8.49 | 27.50 | 5.31 | 18.00 | 3.47 |

These tables show at what distances the fall in rate per ton-kilometer takes place.

The rates on the Chemin de Fer d'Orléans and of the Paris, Lyon and Mediterranean Railway are identical in the first, second, third, fourth, and sixth classes. They differ only in the fifth class for the distances of 300 kilometers (186 miles) and 500 kilometers (311 miles). The bases of these tariffs are kilometric. There exist likewise many fixed rates, but the tendency is to withdraw them in proportion as the new ones are made.

The fixed rates (prix fermes) are rates which are common for different points as well as for different distances.

Example: From Paris to Lyon, according to special tariff No. 14, Paragraph II,[a] the rates given of 35, 27, 24, and 22 francs ($6.75, $5.21, $4.63, and $4.24) are the same as for Melun, Fontainebleau, Montéreau, and Sens, which are much shorter distances from Paris than Lyon.

THE RATES FOR COAL, ORE, AND OTHER SPECIFIED COARSE FREIGHTS.

With this general explanation of the bases of French classification an illustrative example of fast and slow freight rates for different distances, this report now takes up the specific line of inquiry prescribed by the circular instruction of August 16.

I. The first question under the section headed "Railway rates in foreign countries," calls for ten examples of rates on coal on different railway lines for different distances, with certain details (see page 3, Chap. 1):

The following table has been prepared for this report by Mr. James B. Dunning, American consul at Havre, on the basis demanded by the foregoing seven queries. Ten typical distances have been selected, though it is obviously impossible to make a report upon a literal application of the term "ten different railway lines," as used in the instruction calling for the information. Hence, the term "on different railway lines," has been interpreted as seemed most useful to the object of the report, and in view of the division of railway direction in France. An effort has been made to show comparative conditions for

[a] Recueil General, Tarifs des Chemins de Fer No. 275. October, 1909. P. 862.

all sorts of distances and localities, both from tidewater inward and between interior points exclusively. The seven lettered items of question I. will be found tabulated under their corresponding designations, thus:

TABLE I.—*Freight rates for coal.*

| (a) Termini. | (b) Distance in miles. | (c) Terminal charge. | (d/1) Transportation charge. | (d/2) Service included in terminal charge. | (e) Class rate. | (g) Preferential rate. |
|---|---|---|---|---|---|---|
| Havre to Paris[a] | 142 | 0.30 franc ($0.06) | 7 francs ($1.35) | Traction in railroad yard. | Special | Yes. |
| Cherbourg to Paris.[a] | 230 | 0.30+0.40 franc ($0.06 +($0.08). | 14.05 francs ($2.71)[b]<br>10.90 francs ($2.10)[c] | Traction plus yard tax of 8 cents per ton. | do | No. |
| Brest to Paris[a] | 388 | 0.75+0.40 franc ($0.15 +($0.08). | 21 francs ($4.05)[b]<br>15 francs ($2.90)[c] | Traction plus yard tax. | do | No. |
| Marseille to Paris.[a] | 536 | 0.70+0.25 franc ($0.14 +($0.05). | 15.40 francs ($3.00)[c] | Traction plus yard tax. | do | No. |
| St. Nazaire to Paris.[a] | 307 | 0.40 franc ($0.08) | 16.30 francs ($3.15)[b]<br>12.35 francs ($2.38)[c] | Yard tax | do | No. |
| Dieppe to Paris.[a] | 125 | 0.30 franc ($0.06) | 6.50 francs ($1.25)[b].<br>6 francs ($1.16)[c] | Traction | do | Yes. |
| Dunkirk to Paris.[a] | 189 | 0.40 franc ($0.08) | 9.35 francs ($1.80)[b].<br>6.60 francs ($1.27)[c]. | Station tax | do | No. |
| St. Etienne to Lyon.[d] | 36 | 0.25 franc ($0.05) | 3.20 francs ($0.62)[c] | do | do | Yes. |
| Marseille to Lyon.[a] | 217 | 0.70+0.25 franc ($0.15 +($0 05). | 13.70 francs ($2.64)[c] | Traction plus station tax. | do | No. |
| Rouen to Paris[a] | 87 | 0.80 franc | 5.50 francs ($1.06)[b].<br>5.25 francs ($1.01)[c]. | Traction | do | |

[a] Tide water to interior station.
[b] Cars of 5 tons or less.
[c] Cars of 10 tons or more than 5 tons.
[d] Station to station.

It will be noted that the foregoing table omits item (*f*) (see p. 3, Chap. I), the reason being that conditions on all lines are identical, so that the repetition was uncalled for. The terminal charges also have not been given in exact American equivalents, but in the approximate equivalents (for instance, 6 cents as the equivalent for 30 centimes), as it was obvious that the item was wanted for easy comparisons only. The other terms stated in the list of rates are in exact American equivalents.

The difference between the rate for full cars of 10 metric tons and for cars of 5 tons or less is easily seen. The terminal charges cover the cost of sidetracking, or the local station tax, or in some cases both. All the rates are for open cars only. The burden of loading and unloading is on shippers engaged in the trade. The prices are per ton of 1,000 kilograms or the so-called metric ton.

Preferential rates are accorded on shipments from certain points, viz, Havre, Dieppe, and Rouen, and from St. Etienne. In the case of St. Etienne, the lower rate is given to aid the local coal trade of that district in competition with coal from Cardiff and other British markets. In the other three cases the lower rates were given many years ago to favor the business of the respective ports. The cost of carrying Welsh coal over Channel is from 4 shillings to 4 shillings and 3 pence; and from Cardiff to Rouen (the great French coal-importing point), up the River Seine, about 4 shillings 10 pence under ordinary charters.

The schedule for coal is "Special Rate 7," in the French railway category, covering mineral fuels. It is for slow freight only, no other terms being quoted. "Rate 7" is also given to 5-ton carloads of mineral fuels other than straight coal, as briquettes, lignite, coke, peat, and slack.

## COAL SHIPMENTS IN SPECIAL DISTRICTS.

In view of the especial importance attached by the instruction to the rates and conditions which govern the transportation of coal in France, recourse has been had to special reports from Mr. William H. Hunt, American consul at St. Etienne, in the coal and iron district of lower central France, and from Mr. Louis Goldschmidt, consul at Nantes, whose district includes the lower portion of the valley of the Loire. Although governed by nominally uniform tariffs, the coal traffic of these different sections involves certain local conditions, which can only be clearly explained by concrete examples of actual rates and charges between specified points.

The railways in the district of St. Etienne belong to the Paris, Lyon and Mediterranean Railroad Company, which, in common with the other great systems in this country, places at the service of shippers of coal two distinct tariffs, as follows:

First. A general tariff that is embodied in the conditions under which the railway concession was granted to the company. It authorizes the application of the highest tariff rates on shipments which do not satisfy the tonnage regulations that come under the special tariff. These regulations apply to shipments made from one station to any other station (de toute gare à toute gare), without taking into account from what station the shipment is made or to what station it is consigned. This tariff makes a distinction only in the nature of the combustible to be carried. Coal falls under series 6 of the general tariff, while coke comes under series 5 of the same tariff. The freight rates on coal and coke are found under either series 5 or series 6, according to the circumstances and the number of miles they are to be carried.

Below are given two examples of the rates on shipments of coal and coke illustrating the application of series 5 and series 6 of the general tariff:

(1) From St. Etienne to Lyon, 57 kilometers (35 miles), series 6 is applied on a shipment of 6 tons—less than a carload—of coal: St. Etienne to Lyons, 3.30 francs ($0.63) per ton; terminal charges, 0.40 francs ($0.07) per ton; total, 3.70 francs ($0.70) per ton.

(2) From St. Etienne to Lyon series 5 is applied on a shipment of 6 tons of coke: St. Etienne to Lyon, 4.55 francs ($0.88) per ton; terminal charges, 0.40 francs ($0.07) per ton.

The terminal charges, 0.40 francs ($0.07), which are uniformly added to each shipment, represent a fixed terminal charge per ton payable at the terminal station as "frais de gare" when the charges for loading and unloading are paid by the shipper and consignee; this is the general rule for all shipments of coal and coke weighing more than 4 tons.

Second. Special tariff: The Paris, Lyon and Mediterranean Company's "Special Tariff No. 7" embodies important reductions in the freight rates to be charged by the company, but in return they are only accorded to shippers who satisfy certain conditions with regard to capacity and tonnage, who contract to ship not less than a carload lot, and concede the company certain facilities with reference to delays in transportation. Moreover, in order to benefit by the rates under the special tariff it is necessary to make a special request for it.

This Special Tariff No. 7 has been in operation since March 11, 1907. It embraces a fixed tariff and a descending scale of rates based on the mileage. The fixed tariff—or prix exceptionnels—are special rates

made for shipments from a producing center to a point where the products of such manufactory are consumed; they are unchangeable, and the distance the shipment is to be hauled is not taken into consideration.

The descending scale of rates is based on the mileage with a decreasing ratio.

In order to apply this P. L. M. Special Tariff No. 7 there are two classes of shipments to be taken into consideration:

(*a*) Those shipments made from one station on the P. L. M. to any other station on the same line.

(*b*) Those shipments made from a station at which is found a coal mine, briquette fuel factory, coke ovens, or gas works, to any station whatever along the railway line.

(*a*) *For shipments made from one station to another.*—On shipments under this class the tariff is applied to the minimum shipment of a carload—10 tons of coal or 8 tons of coke. But, as cars with a capacity of 8 tons of coke are the exception, on account of its volume, such shipments are given the benefit of the special fixed rate, when they embrace a carload, even though the weight may be less than 8 tons.

Coal and coke are both subject to the transportation rates given in Tariff Sheet No. 1, as well as in the table of fixed rates, and are applied accordingly as they come under either of the classes of shipments (*a*) and (*b*) mentioned above.

To the rates quoted in Special Tariff Sheet No. 1, which are calculated on the mileage basis, there is added a fixed terminal charge (taxe constante) of 0.25 francs ($0.04) per ton, which replaces the one of 0.40 francs ($0.07) "droits de gare." In the fixed rates it is the contrary, as all terminal charges are included in the transportation charges.

Below follow two examples of shipments illustrating the foregoing:

*First. Special tariff where there is a fixed terminal charge.*—From Roanne to Givors, 106 kilometers (66 miles), Special Tariff Sheet No. 1 is applied on a shipment of 10 tons of coal: Roanne to Givors, 5.20 francs ($1) per ton; fixed terminal charges 0.25 francs ($0.04) per ton; total, 5.45 francs ($1.04) per ton.

*Second. Where all charges are included.*—From Villars to Creusot, 187 kilometers (116 miles), the fixed rates are applied on a shipment of 8 tons of coke: Villars to Creusot (all charges included), 6 francs ($1.15) per ton.

(*b*) *For shipments made from station at which is found a coal mine, briquette fuel factory, coke ovens, or gas works.*—On shipments of coal and coke coming under the above category, the same tonnage regulations are applied for carload lots.

The tariff sheet gives a list of the stations which are considered centers of shipment for coal mines and similar establishments mentioned above.

In order to profit by the tariff rates, which are given to encourage the development of the coal-mining industry, it is necessary that coal should be shipped from a coal mine or a briquette fuel factory established at one of the stations named in the list.

When it concerns a shipment of gas coke, and there are gas works established at all points on the line, the list of shipping centers is not applied to these points, except when the gas works are touched

directly by the P. L. M., and the station is entered on the shipping bill as a point of shipment; only in cases of this kind will such a shipment profit by the reduced tariff.

The freight rates applicable to shipments made under the conditions mentioned above are stated on the special tariff sheet or on the fixed rate sheet. There are two of these rates and it is necessary to state the manner in which they are applied to shipments:

Rate sheet No. 2 is applicable on shipments to no matter what destination, while the rates quoted in Paragraph III of Special Tariff No. 7 are only applied on shipments of coal or coke destined for immediate consumption by blast furnaces.

In Tariff Sheet No. 2 the rates are applied according to the mileage the coal or coke is to be hauled, and an additional sum of 0.25 francs ($0.04) per ton is to be added as terminal charges, in a similar manner as in Tariff Sheet No. 1, referred to above.

Then again, it would be well to mention that the freight rates embodied in Tariff Sheet No. 2 are not applied on shipments of coal, briquette fuel, and coke, when they are shipped straight from the mine or works where they are produced, and destined for immediate consumption by steel and iron mills or blast furnaces.

*Reduced rates on carloads.*—All that has been said above with regard to the special rates and terminal charges simply cover minimum shipments of a carload of coal or of coke. For minimum shipments of 6 carload lots there is a reduction of 5 per cent made in the tariff rates mentioned above, but the terminal charges are not affected.

Below follow examples of rates on coal for different distances over the P. L. M. Railway:

*First. General tariff.*—From St. Etienne to Lyon, 57 kilometers (35 miles), series 6, general tariff, is applied on a shipment of 6 tons of coal: St. Etienne to Lyon, 3.30 francs ($0.64) per ton; terminal charges, 0.40 francs ($0.07) per ton; total, 3.70 francs ($0.71) per ton.

*Second. General tariff.*—From Clermont-Ferrand to Vichy, 70 kilometers (43 miles), series 5, general tariff, is applied on a shipment of 8 tons of coke: Clermont-Ferrand to Vichy, 5.60 francs ($1.08) per ton; terminal charges, 0.40 francs ($0.07) per ton; total, 6 francs ($1.15) per ton.

*Third. Special tariff, Table No. 1.*—From Lyon to Valence, 106 kilometers (66 miles), special tariff, Table No. 1, is applied on a shipment of 10 tons of coal: Lyon to Valence, 5.20 francs ($1) per ton; fixed terminal charges, 0.25 francs ($0.04) per ton; total, 5.45 francs ($1.04) per ton.

*Fourth. Special tariff, Table No. 1.*—Is applied on a shipment of 8 tons of coke; made likewise from Lyon to any destination other than to a gas works the same rates in No. 3 above are applied.

*Fifth. General tariff, fixed rates.*—From St. Etienne to Paris, 500 kilometers (311 miles) special tariff, fixed rates, are applied on a shipment of 10 tons of coal or 8 tons of coke, no matter who may be the shipper or consignee, as follows: St. Etienne to Paris, 10 francs ($1.93) per ton.

On the other hand, the same sheet quoted the rate from Villars to Vesoul, 346 kilometers (215 miles), without taking into account the distance, as follows: Villars to Vesoul, 9 francs ($1.73) per ton.

NOTE.—The fixed rates cited above, St. Etienne to Paris and Villars to Vesoul, are applied on all shipments, no matter who may be

the shipper or consignee, on the single condition, that the shipment of coal or coke embraces the minimum quantity provided for in the special tariff.

They are the result of the maintenance in the present tariff of certain rates appearing in the former tariff in force until March 11, 1907, which were lower than the rates established on the mileage basis shown in Tariff Sheet No. 2.

*Sixth. Special tariff, Table No. 2.*—From St. Etienne to Roanne, 82 kilometers (51 miles), special tariff, Table No. 2, is applied on a shipment of 10 tons of coal shipped direct from a coal mine: St. Etienne to Roanne, 3.70 francs ($0.71) per ton; fixed terminal charges, 0.25 franc ($0.04) per ton; total, 3.95 francs ($0.75) per ton.

NOTE.—Example of rate given to encourage the development of coal-mining industry.

*Seventh. Special tariff, Table No. 2.*—La Beraudiere to Marseille, 365 kilometers (287 miles), special tariff, Table No. 2, is applied on a shipment of 8 tons of coke shipped direct from a gas works at La Beraudiere: La Beraudiere to Marseille, 9.50 francs ($1.83) per ton; fixed terminal charges, 0.25 franc ($0.04) per ton; total, 9.75 francs ($1.87) per ton.

*Eighth. Special tariff, Table No. 2.*—The same tariff, except the fixed terminal charges, is imposed on similar shipments of coal from St. Etienne to Roanne, 51 miles, or of coke from La Beraudiere to Marseille, 227 miles, on the condition that the consignee is a steel-rolling mill, iron works, or a blast furnace, as follows: Coal, St. Etienne to Roanne, 3.70 francs ($0.71) per ton; coke, La Beraudiere to Marseille, 9.50 francs ($1.83) per ton.

*Ninth. Paragraph III, special tariff sheet.*—From St. Etienne to Givors, 36 kilometers (22 miles), Paragraph III of special tariff is applied on a shipment of 10 tons of coal shipped direct from a coal mine to a blast furnace for immediate consumption: St. Etienne to Givors, 1.70 francs ($0.33) per ton; terminal charges, 0.40 franc ($0.07) per ton; total, 2.10 francs ($0.40) per ton.

NOTE.—Another example of rate given to encourage the development of industries.

*Tenth. Special tariff reductions for train-load lots.*—For shipments cited in example 3 et seq., if the shipment consists of 60 tons of coal or of 48 tons of coke, a reduction of 5 per cent is customary on the established rates. The rate on 6 carloads of coke from La Beraudiere to Marseille would be: La Beraudiere to Marseille, 9.05 francs ($1.74) per ton; fixed terminal charges, 0.25 franc ($0.04) per ton; total, 9.30 francs ($1.78) per ton.

## SHIPMENTS OF COAL IN THE CONSULAR DISTRICT OF NANTES.

[Report by Consul Louis Goldschmidt.]

### EXAMPLE NO. 1.

(*a*) Nantes to Bourg-la Reine (Paris-Orléans Railway).

(*b*) Four hundred and thirty-eight kilometers (279 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) and for a carload of 10,000 kilos is 10 francs ($1.93), making for 10,000 kilos 100 francs ($19.30), bringing the cost of freight per 2,204 pounds per mile to $0.0068. The transportation charge per 1,000

kilos (2,204 pounds) and for a minimum shipment of 100,000 kilos (220,400 pounds) is 7.80 francs ($1.50), making for 100,000 kilos 780 francs ($150.54). The transportation and terminal charges are not combined. The cost of unloading is as follows: 2.50 francs ($0.48) per 1,000 kilos (2,204 pounds), making for a carload of 10,000 kilos (22,040 pounds) 25 francs ($4.82).

(*d*) The transportation charge covers only the transportation by railway from the point of departure to the point of arrival.

(*e*) The traffic of coal falls under the regular kilometric coal tariff, but very often special tariffs are made at Nantes for special distances. (Special Tariff P. V. Barême 1.)

(*f*) Minimum weight of carload shipment, 10,000 kilos (22,040 pounds). All shipments of coal are made by "petite vitesse" (ordinary freight) in open cars. The transportation charge per ton is the same for a whole train as for a shipment of 100 tons. A train load is composed of 40 cars.

(*g*) Most of the reduced rates of transport on coal have been given to develop some industry.

EXAMPLE NO. 2.

(*a*) Nantes to Bourges (Paris-Orléans Railway).

(*b*) Three hundred and thirty-seven kilometers (209 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) and for a carload of 10,000 kilos (22,040 pounds) is 8.70 francs ($1.67), making for 10,000 kilos, 87 francs ($16.79), and bringing the cost of freight per 2,204 pounds per mile to $0.0079. The transportation charge per 1,000 kilos (2,204 pounds) and for a shipment of 100,000 kilos (220,400 pounds) is 7.05 francs ($1.36), making for 100,000 kilos 705 francs ($136) and bringing the cost of freight per 2,204 pounds per mile to $0.0065. The transportation and terminal charges are not combined.

(*d*) (*e*) (*f*) (*g*) As given in example No. 1.

EXAMPLE NO. 3.

(*a*) Nantes to Amboise (Paris-Orléans Railway).

(*b*) Two hundred and fourteen kilometers (135 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) and for a shipment of 10,000 kilos (22,040 pounds) is 6.20 francs ($1.19), making for 10,000 kilos (22,040 pounds) 62 francs ($11.96) and bringing the cost of freight per 2,204 pounds per mile to $0.0088. The transportation charge per 1,000 kilos (2,204 pounds) and for a shipment of 100,000 kilos (220,400 pounds) is 5.70 francs ($1.10), making for 100,000 kilos 570 francs ($110) and bringing the cost of freight per 2,204 pounds per mile to $0.0080. The transportation and the terminal charges are not combined.

(*d*) (*e*) (*f*) (*g*) As given in example No. 1.

EXAMPLE NO. 4.

(*a*) Nantes to Saint-Nazaire (Paris-Orléans Railway).

(*b*) Seventy-one kilometers (44 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) and for a shipment of 10,000 kilos (22,040 pounds) is 2 francs ($0.38), making for 10,000 kilos (22,040 pounds) 20 francs ($3.86) and

bringing the cost of freight per 2,204 pounds per mile to $0.0083. The transportation and terminal charges are not combined.

(*d*) (*e*) (*f*) (*g*) As given in example No. 1.

EXAMPLE NO. 5.

(*a*) Pornic to Saint-Nazaire (Paris-Orléans Railway and État Railway).

(*b*) One hundred and twenty-one kilometers (74 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 10,000 kilos is calculated as follows: Transportation from Pornic to Nantes (État Railway), 2.90 francs ($0.55) per 1,000 kilos, making for 10,000 kilos: Transportation from Nantes to Saint-Nazaire, 29 francs ($5.59); Paris-Orléans Railway, 2 francs ($0.38) per 1,000 kilos (2,204 pounds), making for 10,000 kilos 20 francs ($3.86); total, 49 francs ($9.45), bringing cost of freight per 1,000 kilos (2,204 pounds) per mile to $0.0125. The transportation and terminal charges are not combined.

(*d*) As given in example No. 1.

(*e*) In this case the shipment in question must pass through (1) the État Railway and (2) through the Paris-Orléans Railway. The transportation charge is given for a shipment of 10,000 kilos, minimum weight of a carload shipment on the Paris-Orléans Railway, while the État Railway admits a minimum of 4,000 kilos (8,816 pounds).

(*f*) (*g*) As given in example No. 1.

EXAMPLE NO. 6.

(*a*) Nantes to Rennes (Ouest Railway).

(*b*) One hundred and thirty kilometers (81 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 9,500 kilos (20,938 pounds) is 6.85 francs ($1.32), making for 9,500 kilos 65.05 francs ($12.55) and bringing the cost of freight per 2,204 pounds per mile to $0.0082. The terminal and transportation charges are not combined.

(*d*) (*e*) As given in example No. 1.

(*f*) Minimum weight of a carload shipment, 9,500 kilos (20,938 pounds).

(*g*) As given in example No. 1.

EXAMPLE NO. 7.

(*a*) Nantes to Pornic (État Railway).

(*b*) Fifty kilometers (31 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 4,000 kilos (8,814 pounds) is 2.90 francs ($0.55), making for 4,000 kilos 11.60 francs ($2.20) and bringing the cost of freight per 2,204 pounds per mile to $0.0017. The terminal and transportation charges are not combined.

(*d*) As given in example No. 1.

(*e*) As given in example No. 1.

(*f*) Minimum weight of a carload shipment, 4,000 kilos (8,816 pounds).

(*g*) As given in example No. 1.

EXAMPLE NO. 8.

(*a*) Pornic to Rennes (État Railway and Ouest Railway).

(*b*) One hundred and eighty kilometers (112 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 9,500 kilos (20,938 pounds) is calculated thus: Transportation from Pornic to Nantes (État Railway) per 1,000 kilos, for a shipment of 9,500 kilos, 2.90 francs ($0.55), making for 9,500 kilos (20,938 pounds) 29 francs ($5.59). Transportation from Nantes to Rennes (Ouest Railway) per 1,000 kilos, for a shipment of 9,500 kilos, 6.85 francs ($1.32), making for 9,500 kilos (20,938 pounds) 65.05 francs ($12.55); total, 94.05 francs ($18.04), bringing the cost of freight per 2,204 pounds per mile to $0.0018.

(*d*) (*e*) As given in example No. 1.

(*f*) Minimum weight of a carload shipment, 9,500 kilos (20,938 pounds).

(*g*) As given in example No. 1.

*Comparative table of cost of freight per kilometric ton and per different distances for coal shipments.*

| Termini. | Distance. | | Cost of freight per 2,204 pounds. | | Cost of freight per 2,204 pounds per mile. | Rate based on minimum shipments for— |
|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Francs. | U. S. currency. | | |
| | | | | | | *Kilos.* |
| État Ry.: | | | | | | |
| Nantes-Pornic | 50 | 31 | 2.90 | $0.55 | $0.017 | 4,000 |
| Ouest Ry: | | | | | | |
| Nantes-Rennes | 130 | 81 | 6.85 | 1.32 | .0082 | 9,500 |
| État and Ouest Ry.: | | | | | | |
| Pornic-Rennes | 180 | 112 | 9.75 | 1.87 | .016 | 9,500 |
| Paris-Orléans Ry.: | | | | | | |
| Nantes-St. Nazaire | 71 | 44 | 2.00 | .38 | .0083 | 10,000 |
| Nantes-Amboise | 217 | 135 | 6.20 | 1.19 | .0088 | 10,000 |
| Nantes-Bourges | 337 | 209 | 8.70 | 1.67 | .0079 | 10,000 |
| Nantes-Bourg-la-Reine | 438 | 279 | 10.00 | 1.93 | .0068 | 10,000 |
| Nantes-Amboise | 217 | 135 | 5.70 | 1.10 | .0080 | 100,000 |
| Nantes-Bourges | 337 | 209 | 7.05 | 1.36 | .0065 | 100,000 |
| Nantes-Bourg-la-Reine | 438 | 279 | 7.80 | 1.50 | .0053 | 100,000 |
| État and Paris-Orléans Rys.: | | | | | | |
| Pornic-St. Nazaire | 121 | 74 | 4.90 | .93 | .012 | 10,000 |

QUESTIONS II AND III.

The seven questions covered in (*a* to *g*) by question 1, have been applied to question 2 to show ten examples of rates on different lines of railway, for different distances, for (1) iron ore, (2) stone, (3) lumber, (4) fertilizers, and (5) grain. And in order to facilitate the work of the student of this report, question 3, on rates granted to export business, has been answered through an extra column added to the tabulations. It has been thought proper to use the distances and termini which formed the base of the table given in the answer to question 1, so that throughout this portion of the report comparisons may be taken upon a more exact and intelligent basis. While the stating of the export rate in the form of an extra column added to the tabulations called for in question 2 of the instructions does not give quite so extensive a view of that item as is suggested, it appears to afford a much clearer idea of the relative position of the matter and to thus better serve the purpose for which the report is being prepared.

In all the following five tables rates are stated on a basis of metric, or long tons. They cover shipments from quay to station for imports, and from station to quay for exports, excepting only, of course, the line from St. Etienne to Lyon, which is all inland. Rates do not include cost of handling, i. e., loading and unloading, which are entirely upon the trade involved.

As in the answer to question 1, column (*f*) is omitted, for the reasons stated there. The answer to questions 2 and 3 should be read in the terms of the supplementary matter which accompanies answer 1. Ore, stone, lumber, and fertilizers are shipped in open cars.

QUESTION II, SECTION III.

*Rates on iron ore.*

| (*a*) Termini. | (*b*) Distance in miles. | (*c*) Terminal charge. | (*d1*) Transportation charge. | (*d2*) Included in terminal charge. | (*e*) Class rate. | (*g*) Preferential. | (Query 3)—export rate. |
|---|---|---|---|---|---|---|---|
| Havre to Paris | 142 | 0.40+0.40 franc ($0.08)+($0.08). | 5.70 francs ($1.10) *a* | Traction and yard tax. | Special No. 13. | No | Same as import. |
| Cherbourg to Paris. | 230 | 0.30+0.40 franc ($0.06)+($0.08). | 8.20 francs ($1.58). *a* | do | do | No | Do. |
| Brest to Paris | 388 | 0.75+0.40 franc ($0.15)+($0.08). | 12 francs ($2.32) *a* | do | do | No | Do. |
| Marseille to Paris. | 536 | 0.70+0.40 franc ($0.14)+($0.08). | 18.50 francs ($3.57). *b* | do | do | No | Do. |
| St. Nazaire to Paris. | 307 | 0.40 franc ($0.08) | 9.50 francs ($1.83). *a* | Yard tax | do | No | Do. |
| Dieppe to Paris. | 125 | 0.30+0.40 franc ($0.06)+($0.08). | 4.65 francs ($0.90). *a* | Traction and yard tax. | do | No | Do. |
| Dunkirk to Paris. | 189 | 0.40 franc ($0.08) | 9.35 francs ($1.80). *b*<br>6.90 francs ($1.33). *a* | Yard tax | do | No | Do. |
| St. Etienne to Lyon. | 36 | 0.40 franc ($0.08) | 3.30 francs ($0.64). *b* | do | do | No | Do. |
| Marseille to Lyon. | 217 | 0.70+0.40 franc ($0.14)+($0.08). | 11.85 francs ($2.29). *b* | Traction and yard tax. | do | No | Do. |
| Rouen to Paris. | 87 | 0.30+0.40 franc ($0.06)+($0.08). | 4.15 francs ($0.80). *a* | do | do | No | Do. |

*a* Cars of 10 tons or more than 5 tons. *b* Cars of 5 tons or less.

In order to render this important section of this report as complete as possible, and to show the slight variations of rates caused by incidental local conditions, there are herewith added two special reports, one of which, from Consul Hunt at St. Etienne, gives a full analysis of the traffic in mineral ores and other heavy material throughout the "réseau" of the Paris, Lyon and Mediterranean Railway, and a similar report from the American consul at Nantes, covering the western portion of France.

ORE TRAFFIC OF THE PARIS, LYON AND MEDITERRANEAN RAILROAD.

The transportation of ores falls under the general tariff, series 6, hauled in bulk with a minimum weight of 4 tons, to which is added the terminal charges.

Below follow a few examples of the application of this tariff. To these sums are added the terminal charges of 40 francs ($0.07) per ton: For a distance of 6 kilometers (3.7 miles), 0.90 francs ($0.17) per ton; for a distance of 50 kilometers (31 miles), 3.40 francs

($0.65) per ton; for a distance of 100 kilometers (62 miles), 5.40 francs ($1.04) per ton; for a distance of 500 kilometers (311 miles), 18.40 francs ($3.55) per ton.

The only advantage shippers have under this tariff is the delay in transportation, which is limited to five days.

In a similar manner, for a distance of 150 kilometers (93 miles), the delay accorded is four whole days, instead of nine days for the special tariff. Likewise for a distance of 500 kilometers (311 miles), the delay accorded is six whole days, instead of eleven days for the special tariff.

*Special tariff on iron and other ores.*—The freight rates on iron and other minerals ores in special tariff No. 13 are applied as follows:

For a full carload the rates in Table F—including the terminal charges—are accorded on the condition that the minimum rate charged is not less than 1 franc ($0.19) per ton.

The application of this rate is shown in the following examples: For a distance of 50 kilometers (31 miles), 3 francs ($0.57) per ton; for a distance of 100 kilometers (62 miles), 4 francs ($0.77) per ton; for a distance of 500 kilometers (311 miles), 12 francs ($2.31) per ton.

*Paragraph III of Special Tariff No. 13.*—Under this tariff iron ores and (crude or screened) manganese ores when shipped directly for consumption to steel works established on the P. L. M. line, which produce crude cast iron, steel, and other metals in a crude state, such as ingots and scrap iron, the rates on a minimum carload of 10 tons are as follows:

From one station to any other station: For a distance of 15 kilometers (9.3 miles), 1.25 francs ($0.24) per ton; for a distance of 50 kilometers (31 miles), 2.25 francs ($0.43) per ton; for a distance of 100 kilometers (62 miles), 3 francs ($0.57) per ton; for a distance of 1,000 kilometers (621 miles), 13 francs ($2.51) per ton.

NOTE.—There is added to the prices given above the terminal charge of $0.07 per ton, while the expenses of loading and unloading are to be paid by the shipper and consignee.

COMPARISON OF RATES UNDER TABLE F AND PARAGRAPH III.

The tables given below show the comparative rates applicable under Table F, and Paragraph III under Special Tariff No. 13, for different stations from Marseille, St. Louis-du-Rhône, and Cette on the P. L. M. Railway line. The rates are on carloads of 10 tons:

| From Marseille to— | Distance. | | On Table F. | |
|---|---|---|---|---|
| | Kilometers. | Miles. | Francs.[a] | U. S. currency. |
| Avignon | 118 | 73 | 4.35 | $0.84 |
| Chasse | 316 | 196 | 8.30 | 1.60 |
| Vienne | 305 | 189 | 8.10 | 1.56 |
| Givors | 320 | 198 | 8.40 | 1.62 |
| Rive-de-Gier | 335 | 208 | 8.70 | 1.68 |
| St. Chamond | 344 | 213 | 8.90 | 1.72 |
| St. Etienne | 356 | 221 | 9.10 | 1.75 |
| Firminy | 360 | 224 | 9.20 | 1.77 |
| Fourchambault | 584 | 363 | 13.70 | 2.64 |
| Creusot | 485 | 301 | 11.70 | 2.26 |
| Fraisans | 541 | 336 | 12.80 | 2.4 |
| Vertaizon | 439 | 273 | 10.80 | 2.08 |
| Paris-Bercy | 826 | 513 | 18.50 | 3.57 |

[a] The rates are charged per ton.

| From Marseille to— | Distance. | | Paragraph III. | |
|---|---|---|---|---|
| | Kilometers. | Miles. | Francs.[a] | U. S. currency. |
| Avignon | 118 | 73 | 3.27 | $0.63 |
| Chasse | 316 | 196 | 6.16 | 1.18 |
| Vienne | 305 | 189 | 6.05 | 1.16 |
| Givors | 320 | 198 | 6.20 | 1.19 |
| Rive-de-Gier | 335 | 208 | 6.35 | 1.22 |
| St. Chamond | 344 | 213 | 6.44 | 1.24 |
| St. Etienne | 356 | 221 | 6.56 | 1.26 |
| Firminy | 360 | 224 | 6.60 | 1.27 |
| Fourchambault | 584 | 363 | 8.84 | 1.70 |
| Creusot | 485 | 301 | 7.85 | 1.51 |
| Fraisans | 541 | 336 | 8.41 | 1.62 |
| Vertaizon | 439 | 273 | 7.39 | 1.42 |
| Paris-Bercy | 826 | 513 | 11.26 | 2.17 |

| From St. Louis-du-Rhône to— | Distance. | | On Table F. | |
|---|---|---|---|---|
| | Kilometers. | Miles. | Francs.[a] | U. S. currency. |
| Audincourt | 599 | 372 | 14.00 | $2.70 |
| Besseges | 149 | 92.5 | 5.00 | .96 |
| Champagnolle | 473 | 294 | 11.45 | 2.21 |
| Foucherans | 480 | 298 | 11.60 | 2.24 |
| Lyon | 303 | 188 | 8.05 | 1.55 |
| Rives | 284 | 176 | 7.70 | 1.49 |
| St. Hippolyte | 618 | 384 | 14.35 | 2.77 |

| From St. Louis-du-Rhône to— | Distance. | | Paragraph III. | |
|---|---|---|---|---|
| | Kilometers. | Miles. | Francs.[a] | U. S. currency. |
| Audincourt | 599 | 372 | 8.99 | $1.73 |
| Besseges | 149 | 92.5 | 3.73 | .72 |
| Champagnolle | 473 | 294 | 7.73 | 1.49 |
| Foucherans | 480 | 298 | 7.80 | 1.50 |
| Lyon | 303 | 188 | 6.03 | 1.16 |
| Rives | 284 | 176 | 5.76 | 1.11 |
| St. Hippolyte | 618 | 384 | 9.18 | 1.77 |

| From Cette to— | Distance. | | On Table F. | |
|---|---|---|---|---|
| | Kilometers. | Miles. | Francs.[a] | U. S. currency. |
| Besançon | 567 | 352 | 13.35 | $2.57 |
| Brignoud | 364 | 226 | 9.30 | 1.79 |
| Clerval | 615 | 382 | 14.30 | 2.76 |
| Imphy | 539 | 335 | 12.80 | 2.47 |
| Montbard | 610 | 379 | 14.20 | 2.74 |
| St. Colombe | 648 | 402 | 14.95 | 2.88 |

| From Cette to— | Distance. | | Paragraph III. | |
|---|---|---|---|---|
| | Kilometers. | Miles. | Francs.[a] | U. S. currency. |
| Besançon | 567 | 352 | 8.67 | $1.67 |
| Brignoud | 364 | 226 | 6.64 | 1.28 |
| Clerval | 615 | 382 | 9.15 | 1.76 |
| Imphy | 539 | 335 | 8.39 | 1.62 |
| Montbard | 610 | 379 | 9.10 | 1.75 |
| St. Colombe | 648 | 402 | 9.48 | 1.83 |

[a] The rates are charged per ton.

The transportation of such merchandise by fast freight is too costly and it is not considered practicable.

Below are given rates per ton applied for different distances on iron and other mineral ores when transported by fast freight trains: For a distance of 599 kilometers (372 miles), 175.25 francs ($33.82); for a distance of 567 kilometers (352 miles), 166.90 francs ($32.21); for a distance of 303 kilometers (188 miles), 94.35 francs ($18.21).

Paragraph III of Special Tariff No. 13 was established to encourage the development of the iron and steel industries.

### SHIPMENTS OF IRON ORE IN WESTERN FRANCE.

#### EXAMPLE NO. 1.

(*a*) Nantes to Cholet (État Railway Company).

(*b*) Sixty kilometers (37 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 4,000 kilos, is 3.25 francs ($0.62), making for 4,000 kilos (8,816 pounds) 13 francs ($2.42), and bringing the cost of freight per 2,204 pounds per mile to $0.016. The terminal and transportation charges are not combined.

(*d*) The transportation charge covers only the transportation from the point of departure to the point of arrival.

(*e*) The traffic of iron ore falls under a special tariff based on shipments per 20,000 kilos (44,080 pounds).

(*f*) Minimum weight of a carload shipment of iron ore, 4,000 kilos (8,816 pounds). It is rare to make shipments by great quantity or whole train. Iron ore is loaded upon open cars. For a delay in the unloading of a carload of iron ore a charge of 10 francs ($1.93) must be paid by the consignee per carload of 10,000 kilos and per each day of delay. Example: If a carload of iron ore is unloaded only two days after its arrival at the point of destination the consignee must pay 10 times 4, or 40 francs ($7.72). This charge is a very high one, but is not often applied, the consignee always unloading the goods in due time.

(*g*) Most of the reduced rates on ore have been given to develop some industry.

#### EXAMPLE NO. 2.

(*a*) Nantes to Tours (Paris–Orléans Railway).

(*b*) One hundred and ninety-six kilometers (121 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) is 8.75 francs ($1.68), making for a shipment of 5,000 kilos 43.75 francs ($8.40) and bringing the cost of freight per 2,204 pounds per mile to $0.013. The transportation charge per 1,000 kilos (2,204 pounds) per shipment of 20,000 kilos (44,080 pounds) is 4.55 francs ($0.87), making for a shipment of 20,000 kilos 91 francs ($17.50), and bringing cost of freight per 2,204 pounds per mile to $0.0071. The terminal and transportation charges are not combined.

(*d*) (*e*) As given in example No. 1.

(*f*) Minimum weight of a carload shipment, 5,000 kilos (11,020 pounds).

(*g*) As given in example No. 1.

EXAMPLE NO. 3.

(*a*) Nantes to Angers (Paris-Orléans Railway).

(*b*) Eighty-eight kilometers (55 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 5,000 kilos (11,020 pounds) is 4.40 francs ($0.84) making for 5,000 kilos, 22 francs ($4.20) and bringing the cost of freight per 2,204 pounds per mile to $0.015. The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 20,000 kilos (44,080 pounds) is 2.40 francs ($0.46) making for 20,000 kilos, 48 francs ($9.20) and bringing the cost of freight per 2,204 pounds per mile to $0.0083. The transportation charge and the terminal charge are not combined.

(*d*) (*e*) (*f*) (*g*) As given in example No. 2.

*Comparative table of cost of freight, per kilometric ton, and per different distances for shipments of iron ore.*

| Termini. | Distance. | | Cost of freight per 2,204 pounds. | | Cost of freight per 2,204 pounds per mile. | Rate based on minimum shipments for— |
|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Francs. | U. S. currency. | | |
| État Ry.: | | | | | | *Kilos.* |
| Nantes-Cholet | 60 | 37 | 3.25 | $0.62 | $0.016 | 4,000 |
| Paris-Orléans Ry.: | | | | | | |
| Nantes-Tours | 196 | 121 | 8.75 | .68 | .013 | 5,000 |
| Nantes-Angers | 88 | 55 | 4.40 | .84 | .015 | 5,000 |
| Paris-Orléans Ry.: | | | | | | |
| Nantes-Tours | 196 | 121 | 4.55 | .87 | .0071 | 20,000 |
| Nantes-Angers | 88 | 55 | 2.40 | .46 | .0083 | 20,000 |

QUESTION II, SECTION 2.

*Freight rates on stone.*

| (*a*) Termini. | (*b*) Distance in miles. | (*c*) Terminal charge. | (*d*/1) Transportation charge. | (*d*/2) Included in terminal charge. | (*e*) Class rate. | (*g*) Preferential. | Query 3—Export rate. |
|---|---|---|---|---|---|---|---|
| Havre-Paris | 142 | 0.40+0.40 franc ($0.08+$0.08). | 9.80 francs ($1.89).*a*<br>6.40 francs ($1.24).*b* | Traction and yard tax. | Special | No | 6.50 francs ($1.26). |
| Cherbourg-Paris. | 230 | 0.30+0.40 franc ($0.06+$0.08). | 14.05 francs ($2.71).*a*<br>8.55 francs ($1.65).*b* | do | do | No | 9.40 francs ($1.81). |
| Brest-Paris | 368 | 0.75+0.40 franc ($0.15+$0.08). | 20.50 francs ($3.96).*a*<br>12 francs ($2.32).*b* | do | do | No | 14 francs ($2.70). |
| Marseille-Paris | 536 | 0.85+0.40 franc ($0.17+$0.08). | 17.50 francs ($3.38). | do | do | No | 17.50 francs ($3.38). |
| St. Nazaire-Paris. | 307 | 0.40 franc ($0.08) | 16.30 francs ($2.15).*a*<br>9.65 francs ($1.86).*b* | Yard tax | do | No | 10.85 francs ($2.09). |
| Dieppe-Paris | 125 | 0.30+0.40 franc ($0.06+$0.08). | 7.80 francs ($1.51).*a*<br>5.30 francs ($1.02).*b* | Traction and yard tax. | do | No | 5.30 francs ($1.02). |
| Dunkirk-Paris | 189 | 0.40 franc ($0.08) | 6.60 francs ($1.27). | Yard tax | do | No | 6.60 francs ($1.27). |
| St. Etienne-Lyon. | 36 | 0.40 franc ($0.08) | 2.30 francs ($0.44). | do | do | No | None. |
| Marseille-Lyon. | 217 | 0.85+0.40 franc ($0.17+$0.08). | 10.85 francs ($2.09). | Traction and yard tax. | do | No | 10.85 francs ($2.09). |
| Rouen-Paris | 87 | 0.30+0.40 franc ($0.06+$0.08). | 6.75 francs ($1.30).*a*<br>4.70 francs ($0.91).*b* | do | do | No | 4.70 francs ($0.91). |

*a* Cars of 5 tons or less. *b* Cars of 10 tons or more than 5 tons.

FREIGHT RATES ON STONE, PARIS, LYON AND MEDITERRANEAN R. R.

*General tariff.*—On the P. L. M. general tariff sheet, stone comes under series 5. It is divided into two categories, and a distinction is made between rough stone and stone partially dressed.

On the Special Tariff No. 11, rough stone falls under Tables E, F, "C." The rates on Table E are applicable to a minimum charge of 2 francs ($0.38) per ton, whereas, Table F, when it is applied jointly with Table E, calls for a minimum charge of 10 francs ($1.93) per ton. The rates given in both tables include the terminal charges, as well as the charges for loading and unloading. The shipper is authorized to assume the responsibility of loading and the consignee that of unloading, when such privilege is assumed by the parties interested, the railway company deducts from the charges a sum of .30 franc ($0.05) per ton for each operation. Partially dressed stone also comes under Tables E and "C," as in the case of rough stone above, with all charges included.

*General tariff rates.*—Below follow examples of shipments showing the application of the rates charged per ton in series 5 of the general tariff for different distances: For a distance of 6 kilometers (3.7 miles), 1.50 francs ($0.29); for a distance of 50 kilometers (31 miles), 5 francs ($0.96); for a distance of 100 kilometers (62 miles), 9 francs ($1.73); for a distance of 500 kilometers (311 miles), 28.50 francs ($5.50).

*Special Tariff No. 11.*—Under this tariff there is an allowance of five days' delay in transportation.

Below follow examples of shipments of 5 tons under the rates in Table E. These rates which are charged per ton include also the terminal and all other charges: For a distance of 50 kilometers (31 miles), 3 francs ($0.58); for a distance of 100 kilometers (62 miles), 4.50 francs ($0.87); for a distance of 500 kilometers (311 miles), 14.50 francs ($2.80).

Below follow examples showing the comparative application of the rates in the general tariff and in Special Tariff No. 11 for different distances from Marseille to divers points.

The rates in the special tariff come under Tables E and F. It is well to note the fact that the rate of 10 francs ($1.93) per ton under Table F is not granted for a distance less than 321 kilometers (200 miles):

| From Marseille to— | Distance. | | General tariff rates, sixth series. | |
|---|---|---|---|---|
| | Kilometers. | Miles. | Francs.[a] | U. S. currency. |
| Arles | 84 | 52 | 7.70 | $1.48 |
| Avignon | 118 | 73 | 10.45 | 2.01 |
| Montelimar | 186 | 115 | 15.50 | 2.99 |
| Valence | 231 | 143 | 17.75 | 3.42 |
| Vienne | 305 | 189 | 20.70 | 3.99 |
| Lyon | 336 | 209 | 21.95 | 4.23 |
| Châlon-sur-Saône | 463 | 288 | 27.00 | 5.21 |
| Dijon | 531 | 330 | 29.75 | 5.74 |
| Sens | 715 | 444 | 37.10 | 7.16 |
| Paris | 826 | 513 | 41.55 | 8.02 |

[a] The rates are charged per ton.

| From Marseille to— | Distance. | | Special Tariff No. 11, Table E. | |
|---|---|---|---|---|
| | Kilometers. | Miles. | Francs.[a] | U. S. currency |
| Arles | 84 | 52 | 4.00 | $0.77 |
| Avignon | 118 | 73 | 4.85 | .93 |
| Montélimar | 186 | 115 | 6.65 | 1.28 |
| Valence | 231 | 143 | 7.80 | 1.50 |
| Vienne | 305 | 189 | 9.65 | 1.86 |

| From Marseille to— | Distance. | | Table F. | |
|---|---|---|---|---|
| | Kilometers. | Miles. | Francs.[a] | U. S. currency. |
| Lyon | 336 | 209 | 10.00 | $1.93 |
| Châlon-sur-Saône | 463 | 288 | 11.25 | 2.17 |
| Dijon | 531 | 330 | 12.60 | 2.43 |
| Sens | 715 | 444 | 16.30 | 3.14 |
| Paris | 826 | 513 | 18.50 | 3.75 |

[a] The rates are charged per ton.

In the rates quoted above under Special Tariff No. 11, in Tables E and F, all charges are included, except in cases where the loading and unloading of the merchandise is assumed by the shipper and consignee, in which case a reduction is allowed in these rates of 0.30 franc ($0.05) per ton to the shipper and consignee. The rates in Special Tariff No. 11 under Tables E and F were established to encourage the development of the building industries in French provincial cities and towns. The shipping rates on stone by fast freight trains are too high to render such shipment practicable.

## RAILWAY FREIGHT RATES FOR STONE IN WESTERN FRANCE.

### EXAMPLE NO. 1.

(*a*) Nantes to Cholet (État Railway).

(*b*) Sixty kilometers (37 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 4,000 kilos (8,816 pounds) is 3.40 francs ($0.65), making for 4,000 kilos 13.60 francs ($2.65), and bringing the cost of freight per mile to $0.017. The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 20,000 kilos is 3.25 francs ($0.62), making for 20,000 kilos (44,080 pounds) 65 francs ($12.40), and bringing the cost of freight per 2,204 pounds per mile to $0.016. The transportation charge and the terminal charge are not combined.

(*d*) The transportation charge covers only the transportation from the point of shipment to the point of arrival.

(*e*) The traffic of stone falls under the tariff per kilometer and is based on shipments per 20,000 kilos (44,080 pounds).

(*f*) Minimum weight of a carload shipment, 4,000 kilos (8,816 pounds). Stone is loaded on open cars. A delay of transportation of twenty-four hours per fraction of 77 miles is granted, plus one day for loading and one day for unloading. For a delay in unloading a

shipment of stone the same charge as for a shipment of iron ore must be paid by the consignee.

(*g*) No.

EXAMPLE NO. 2.

(*a*) Nantes to Tours (Paris-Orléans Railway).

(*b*) One hundred and ninety-six kilometers (121 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 5,000 kilos (11,020 pounds) is 6.50 francs ($1.25), making for 5,000 kilos 33 francs ($6.25), and bringing the cost of freight per 2,204 pounds per mile to $0.010. The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 20,000 kilos is the same. The terminal and transportation charges are not combined.

(*d*) (*e*) As given in example No. 1.

(*f*) Minimum weight of a carload shipment, 5,000 kilos (11,020 pounds).

EXAMPLE NO. 3.

(*a*) Nantes to Angers (Paris-Orléans Railway).

(*b*) Eighty-eight kilometers (55 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 5,000 kilos (11,020 pounds) is 3 francs ($0.57), making for 5,000 kilos, 15 francs ($2.85) and bringing the cost of freight per 2,204 pounds per mile to $0.010.

The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 20,000 kilos (44,080 pounds) is the same. (*d*), (*e*), (*f*), (*g*), as given in example No. 2.

*Comparative table of cost of freight per kilometric ton, and per different distances, for shipments of stone.*

| Termini. | Distance. | | Cost of freight per 2,204 pounds. | | Cost of freight per 2,204 pounds per mile. | Rate based on minimum shipments for— |
|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Francs. | U. S. currency. | | |
| État Ry.: | | | | | | *Kilos.* |
| Nantes-Cholet | 60 | 37 | 3.40 | $0.65 | $0.017 | 4,000 |
| Nantes-Cholet | 60 | 37 | 3.25 | .62 | .016 | 20,000 |
| Paris-Orléans Ry.: | | | | | | |
| Nantes-Tours | 196 | 121 | 6.50 | 1.25 | .010 | 5,000 |
| Nantes-Angers | 88 | 55 | 3.00 | .57 | .010 | 5,000 |

QUESTION II, SECTION 3.

*Freight rates on lumber.*

| (a) Termini. | (b) Distance in miles. | (c) Terminal charge. | (d/1) Transportation charge. | (d/2) Included in terminal charge. | (e) Class of rate. | (g) Preferential. | Query 3—export rate. |
|---|---|---|---|---|---|---|---|
| Havre-Paris | 142 | 0.40 franc ($0.08) | 8.50 francs ($1.64). | Traction | Special No. 9. | Yes | 7.50 francs ($1.45). |
| Cherbourg-Paris | 230 | 0.30+0.40 franc ($0.06+$0.08). | 11.05 francs ($2.13). | Traction and yard tax. | do | Yes | 10.40 francs ($2). |
| Brest-Paris | 388 | 0.75+0.40 franc ($0.15+$0.08). | 14.50 francs ($2.80). | do | do | Yes | 15 francs ($2.90). |
| Marseille-Paris | 536 | 1+0.40 franc ($0.20+$0.08). | 26.65 francs ($5.14). | do | do | No | 22.50 francs ($4.34). |
| St. Nazaire-Paris. | 307 | 0.40 franc ($0.08) | 12.20 francs ($2.35). | Yard tax | do | Yes | 11.85 francs ($2.29). |
| Dieppe-Paris | 125 | 0.30 franc ($0.06) | 7.25 francs ($1.40). | Traction | do | Yes | 6.25 francs ($1.21). |
| Dunkirk-Paris | 189 | 0.40 franc ($0.08) | 9.35 francs ($1.80). | Yard tax | do | No | 8 francs ($1.54). |
| St. Etienne-Lyons. | 36 | 0.40 franc ($0.08) | 3.60 francs ($0.69). | do | do | No | None. |
| Marseille-Lyons. | 217 | 1+0.40 franc ($0.20+$0.08). | 17.80 francs ($3.44). | Traction and yard tax. | do | No | 14.35 francs ($2.77). |
| Rouen-Paris | 87 | 0.30 franc ($0.06) | 6 francs ($1.16). | Traction | do | Yes | 5.55 francs ($1.07). |

NOTE.—At Dieppe and Rouen the yard tax of 8 cents per ton is abated on import shipments destined for Paris. At Lyon and St. Etienne there are no terminal charges for lumber handled in export trade.

The above rates are for shipments of 5 tons or less.

SHIPMENTS OF LUMBER IN WESTERN FRANCE

EXAMPLE NO. 1.

(*a*) Nantes to Cholet (État Railway).

(*b*) Sixty kilometers (37 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 4,000 kilos (8,816 pounds) is 3.40 francs ($0.65), making the charge for 4,000 kilos 13.60 francs ($2.65) and bringing the cost of freight per 2,204 pounds per mile to $0.017. The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 20,000 kilos (44,080 pounds) is the same. The transportation and the terminal charges are not combined.

(*d*) The transportation charge covers only the transportation from the point of shipment to the point of arrival.

(*e*) The traffic of lumber falls under the tariff per kilometer and is based on shipments per 20,000 kilos (44,080 pounds).

(*f*) Minimum weight of a carload shipment, 4,000 kilos (8,816 pounds). Lumber is loaded on open cars. A delay of transportation of twenty-four hours per fraction of 77 miles is granted, plus one day for loading and one day for unloading. The charge to be paid by the consignee for a delay in the unloading of a carload is the same as for stone.

(*g*) None.

EXAMPLE NO. 2.

(*a*) Nantes to Tours (Paris-Orléans Railway).
(*b*) One hundred and ninety-six kilometers (121 miles).
(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for of shipment of 5,000 kilos is 6 francs ($1.15), making for 5,000 kilos (11,020 pounds) 30 francs ($5.75) and bringing the cost of freight per 2,204 pounds per mile to $0.009. The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 20,000 kilos (44,080 pounds) is the same.
(*d*) (*e*) As given in example No. 1.
(*f*) Minimum weight of a carload shipment, 5,000 kilos (11,020 pounds).
(*g*) None.

EXAMPLE NO. 3.

(*a*) Nantes to Angers (Paris-Orléans Railway).
(*b*) Eighty-eight kilometers (55 miles).
(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 5,000 kilos is 3 francs ($0.57), making the charge for 5,000 kilos (11,020 pounds) 15 francs ($2.85) and bringing the cost of freight per 2,204 pounds per mile to $0.01. The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 20,000 kilos (44,080 pounds) is the same.
(*d*) (*e*) (*f*) (*g*) As given in example No. 2.

EXAMPLE NO. 4.

(*a*) St. Nazaire to Tours (Paris-Orléans Railway).
(*b*) Two hundred and sixty-seven kilometers (175 miles).
(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 5,000 kilos (11,020 pounds) is 8 francs ($1.54), making the charge for 5,000 kilos 40 francs ($7.70) and bringing the cost of freight per 2,204 pounds per mile to $0.008.
(*d*) (*e*) (*f*) (*g*) As given in example No. 2.

EXAMPLE NO. 5.

(*a*) St. Nazaire to Limoges via Tours (Paris-Orléans Railway).
(*b*) Five hundred and fifty-two kilometers (343 miles).
(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 5,000 kilos (11,020 pounds) is 12.50 francs ($2.41), making for 5,000 kilos 62.50 francs ($12.05) and bringing the cost of freight per 2,204 pounds per mile to $0.007.
(*d*) (*e*) (*f*) (*g*) As given in example No. 2.

EXAMPLE NO. 6.

(*a*) Nantes to Paris via Tours (Paris-Orléans Railway).
(*b*) Four hundred and thirty-one kilometers (268 miles).
(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 5,000 kilos is 12.55 francs ($2.42) making for 5,000 kilos (11,020 pounds) 62.75 francs ($12.10) and bringing the cost of freight per 2,204 pounds per mile to $0.009.
(*d*) (*e*) (*f*) (*g*) As given in example No. 2.

EXAMPLE NO. 7.

(*a*) Nantes to Lyon (via Tours and Saincaize, Paris-Orléans and Paris-Lyon-Mediterranean railways).

(*b*) Six hundred and thirty-seven kilometers (396 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 5,000 kilos (11,020 pounds) is 27.25 francs ($5.25) making for 5,000 kilos, 136.25 francs ($26.25), and bringing the cost of freight per 2,204 pounds per mile to $0.013. The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 7,000 kilos (15,428 pounds) is the following: 20.85 francs ($4.02) making for a shipment of 7,000 kilos (15,428 pounds) 145.95 francs ($28.14), and bringing the cost of freight per 2,204 pounds per mile to $0.010.

(*d*) (*e*) (*f*) (*g*) As given in example No. 2.

EXAMPLE NO. 8.

(*a*) Nantes to Rennes (Ouest Railway).

(*b*) One hundred and thirty kilometers (81 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 5,000 kilos (11,020 pounds) is 6 francs ($1.15) making for 5,000 kilos, 30 francs ($5.75) and bringing the cost of freight per 2,204 pounds per mile to $0.014.

(*d*) (*e*) (*f*) (*g*) As given in example No. 2.

*Comparative table of cost of freight per kilometric ton, and per different distances, for shipments of lumber.*

| Termini. | Distance. | | Cost of freight per 2,204 pounds. | | Cost of freight per 2,204 pounds per mile. | Rate based on minimum shipments for— |
|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Francs. | U. S. currency. | | |
| État Ry.: | | | | | | *Kilos.* |
| Nantes–Cholet | 60 | 37 | 3.40 | $0.65 | $0.017 | 4,000 |
| Paris–Orléans Ry.: | | | | | | |
| Nantes–Tours | 196 | 121 | 6.60 | 1.15 | .009 | 5,000 |
| Nantes–Angers | 88 | 55 | 3.00 | .57 | .010 | 5,000 |
| St. Nazaire–Tours | 267 | 175 | 8.00 | 1.54 | .008 | 5,000 |
| St. Nazaire–Limoges | 552 | 343 | 12.50 | 2.41 | .007 | 5,000 |
| Nantes–Paris | 431 | 268 | 12.55 | 2.42 | .009 | 5,000 |
| Paris–Orléans and P. L. M. Ry.: | | | | | | |
| Nantes–Lyon | 637 | 396 | 27.25<br>20.85 | 5.25<br>4.02 | .013<br>.010 | 5,000<br>7,000 |

QUESTION II. SECTION 4.

*Freight rates on fertilizers.*

| (a) Termini. | (b) Distance in miles. | (c) Terminal charge. | (d/1) Transportation charge. | (d/2) Included in terminal charge. | (e) Class of rate. | (g) Preferential. | Query 3—Export rate. |
|---|---|---|---|---|---|---|---|
| Havre-Paris | 142 | 0.40 + 0.40 franc ($0.08)+($0.08). | 6.40 francs ($1.24). | Traction and yard tax. | Special No. 22. | No | 6.40 francs ($1.24). |
| Cherbourg-Paris | 230 | 0.30 + 0.40 franc ($0.06)+($0.08). | 8.55 francs ($1.65). | do | do | No | 8.55 francs ($1.65). |
| Brest-Paris | 388 | 0.75 + 0.40 franc ($0.15)+($0.08). | 12 francs ($2.32). | do | do | No | 12 francs ($2.32). |
| Marseille-Paris | 536 | 0.85 + 0.40 franc ($0.17)+($0.08). | 18.50 francs ($3.57). | do | do | No | 18.50 francs ($3.57). |
| St. Nazaire-Paris | 307 | 0.40 franc ($0.08) | 9.65 francs ($1.86). | Yard tax | do | No | 9.65 francs ($1.86). |
| Dieppe-Paris | 125 | 0.30 + 0.40 franc ($0.06)+($0.08). | 5.30 francs ($1.02). | Traction and yard tax. | do | No | 5.30 francs ($1.02). |
| Dunkirk-Paris | 189 | 0.40 franc ($0.08) | 7.35 francs ($1.42).[a] / 8.25 francs ($1.60). | Yard tax | do | No | 7 francs ($1.35). |
| St. Etienne-Lyon. | 36 | 0.40 franc ($0.08) | 3.30 francs ($0.64). | do | do | No | None. |
| Marseille-Lyon. | 217 | 0.85 + 0.40 franc ($0.17)+($0.08). | 11.85 francs ($2.29). | Traction and yard tax. | do | No | 11.85 francs ($2.29). |
| Rouen-Paris | 87 | 0.30 + 0.40 franc ($0.06)+($0.08). | 4.70 francs ($0.91). | do | do | No | 4 francs ($0.77). |

The above rates are for fertilizers shipped in cars of 5 tons or less except those marked (*a*) which are for 10 tons). At Dieppe and Rouen the yard tax terminal charge is abated on export shipments of fertilizers.

SHIPMENTS OF FERTILIZERS IN THE DISTRICT OF NANTES.

EXAMPLE NO. 1.

(*a*) Nantes to Cholet (État Railway).

(*b*) Sixty kilometers (37 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 4,000 kilos (8,816 pounds) is 3.15 francs ($0.60), making for 4,000 kilos 12.60 francs ($2.40), and bringing the cost of freight per 2,204 pounds per mile to $0.016. The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 20,000 kilos is 2.40 francs ($0.46), making for 20,000 kilos 48 francs ($9.20) and bringing the cost of freight per 2,204 pounds per mile to $0.012. The transportation and terminal charges are not combined.

(*d*) The transportation charge covers only the transportation from the point of departure to the point of arrival.

(*e*) The traffic of fertilizers falls under the tariff per kilometer and is based on shipments per 20,000 kilos (44,080 pounds).

(*f*) Minimum weight of a carload shipment, 4,000 kilos (8,816 pounds). Fertilizers are loaded in closed cars. The delay of transportation is twenty-four hours per fraction of 77 miles, plus one day for loading and one day for unloading. The charge to be paid by the consignee for delay in unloading a fertilizer shipment is the same as for a lumber shipment.

(*g*) No.

EXAMPLE NO. 2.

(*a*) Nantes to Tours (Paris-Orléans Railway).

(*b*) One hundred and ninety-six kilometers (121 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 5,000 kilos is 7 francs ($1.35), making for 5,000 kilos (11,020 pounds) 35 francs ($6.75) and bringing the cost of freight per 2,204 pounds per mile to $0.011. The transportation charge is the same for 20,000 kilos (44,080 pounds).

(*d*) (*e*) As given in example No. 1.

(*f*) Minimum weight of a carload shipment, 5,000 kilos (11,020 pounds).

(*g*) None.

EXAMPLE NO. 3.

(*a*) Nantes to Angers (Paris-Orléans Railway).

(*b*) Eighty-eight kilometers (55 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 5,000 kilos (11,020 pounds) is 4.50 francs ($0.86), making for 5,000 kilos 22.50 francs ($4.30) and bringing the cost of freight per 2,204 pounds per mile to $0.015. The transportation charge per 1,000 kilos is the same for a shipment of 20,000 kilos (44,080 pounds).

(*d*) (*e*) (*f*) (*g*) As given in example No. 2.

*Comparative table of cost of freight per kilometric ton and per different distances for shipments of fertilizers.*

| Termini. | Distance. | | Cost of freight per 2,204 pounds. | | Cost of freight per 2,204 pounds per mile. | Rate based on minimum shipments for— |
|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Francs. | U. S. currency. | | |
| État Rwy.: | | | | | | *Kilos.* |
| Nantes–Cholet | 60 | 37 | 3.15 | $0.60 | $0.016 | 4,000 |
| | | | 2.40 | .46 | .012 | 20,000 |
| Paris-Orléans Rwy.: | | | | | | |
| Nantes–Tours | 196 | 121 | 7.00 | 1.35 | .011 | 5,000 |
| Nantes–Angers | 88 | 55 | 4.50 | .86 | .015 | 5,000 |

QUESTION II, SECTION 5.

*Freight rates on grain (to be shipped in closed cars).*

| (*a*) Termini. | (*b*) Distance in miles. | (*c*) Terminal charge. | (*d*/1) Transportation charge. | (*d*/2) Included in (*c*) terminal charge. | (*e*) Class of rate. | (*g*) Preferential. | Query 3—Export rate (5-ton cars). |
|---|---|---|---|---|---|---|---|
| Havre–Paris | 142 | 0.40 franc ($0.08) | 8.50 francs ($1.64). | Traction | Special No. 2. | Yes | 7.50 francs ($1.45). |
| Cherbourg–Paris. | 230 | 0.30+0.40 franc ($0.06+$0.08). | 12.65 francs ($2.44). | Traction and yard tax. | do | No | 10.40 francs ($2). |
| Brest–Paris | 388 | 0.75+0.40 franc ($0.15 + $0.08). | 16.75 francs ($3.23). | do | do | No | 15 francs ($2.90). |
| Marseille–Paris | 536 | 1.00 + 0.40 franc ($0.20 + $0.08). | 19.25 francs ($3.72). 17.75 francs ($3.44).[a] | do | do | No | Same as import. |
| St. Nazaire–Paris. | 307 | 0.40 franc ($0.08) | 14.10 francs ($2.72). | Yard tax | do | No | 11.85 francs ($2.29). |
| Dieppe–Paris | 125 | 0.30 franc ($0.06) | 7.15 francs ($1.38). | Traction | do | Yes | 6.25 francs ($1.21). |
| Dunkirk–Paris | 189 | 0.40 franc ($0.08) | 10.60 francs ($2.05). 9.35 francs ($1.80).[a] | Yard tax | do | No | 8 francs ($1.54). |
| St. Etienne–Lyon. | 36 | 0.40 franc ($0.08) | 3.75 francs ($0.72). | do | do | No | None. |
| Marseille–Lyon. | 217 | 1.00 franc ($0.20) | 14.00 francs ($2.70). | Traction | do | Yes | 14 francs ($2.70). |
| Rouen–Paris | 87 | 0.30 franc ($0.06) | 5.75 francs ($1.11). | do | do | Yes | 5.55 francs ($1.07). |

All above rates (except those marked (a), which are for 10-ton cars) are for cars of 5 tons or less. At Havre, Dieppe, and Rouen export shipments of grain pay the yard tax terminal charge of 8 cents per ton.

### SHIPMENTS OF GRAIN IN WESTERN FRANCE.

#### EXAMPLE NO. 1.

(*a*) Nantes to Cholet (État Railway).
(*b*) Sixty kilometers (37 miles).
(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 4,000 kilos (8,816 pounds) is 3.40 francs ($0.65), making for 4,000 kilos 13.60 francs ($2.65) and bringing the cost of freight per 2,204 pounds per mile to $0.017. The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 20,000 kilos is the same. The transportation and terminal charges are not combined The cost of unloading a carload of grain is 0.30 francs ($0.05), making for a carload of 4,000 kilos 1.20 francs ($0.23).
(*d*) The transportation charge covers only the transportation by rail from the point of departure to the point of arrival.
(*e*) The traffic of grain falls under the tariff per kilometer, and is based on shipments per 20,000 kilos (44,080 pounds). Grain is loaded in closed cars, in bags. The transportation delay is twenty-four hours per fraction of 77 miles, plus one day for loading and one day for unloading.
(*g*) None.

#### EXAMPLE NO. 2.

(*a*) Nantes to Pornic (État Railway).
(*b*) Fifty kilometers (31 miles).
(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 4,000 kilos (8,816 pounds), is 3.05 francs ($0.58), making for 4,000 kilos 12.20 francs ($2.35), bringing the cost of freight per 2,204 pounds per mile to $0.018.
(*d*) (*e*) (*f*) (*g*) As given in example No. 1.

#### EXAMPLE NO. 3.

(*a*) Pornic to St. Nazaire (État and Paris-Orléans railways).
(*b*) One hundred and twenty-one kilometers (74 miles).
(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 4,000 kilos is calculated thus: Transportation from Pornic to Nantes, for a shipment of 4,000 kilos (8,816 pounds), 12.20 francs ($2.35); transportation from Nantes to St. Nazaire for a shipment of 4,000 kilos, at 4 francs ($0.77) per 1,000 kilos (2,204 pounds), 16 francs ($2.68); total, 28.20 francs ($5.03), bringing the cost of freight per 2,204 pounds per mile to $0.018.
(*d*) (*e*) (*f*) (*g*) As given in example No. 1.

#### EXAMPLE NO. 4.

(*a*) Nantes to Tours (Paris-Orléans Railway).
(*b*) One hundred and ninety-six kilometers (121 miles).
(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 5,000 kilos is 7 francs ($1.35), making for 5,000 kilos (11,020 pounds) 35 francs ($6.75), and bringing the cost of freight per

2,204 pounds per mile to $0.011. The transportation charge per 1,000 kilos for a shipment of 20,000 kilos (44,080 pounds) is the same.

(*d*) (*e*) As given in example No. 1.

(*f*) Minimum weight of a carload shipment, 5,000 kilos (11,020 pounds).

(*g*) As given in example No. 1.

EXAMPLE NO. 5.

(*a*) Nantes to Angers (Paris-Orléans Railway).

(*b*) Eighty-eight kilometers (55 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 5,000 kilos is 4.50 francs ($0.86), making for 5,000 kilos (11,020 pounds) 22.50 francs ($4.30), and bringing the cost of freight per 2,204 pounds per mile to $0.015.

(*d*) (*e*) (*f*) (*g*) As given in example No. 3.

EXAMPLE NO. 6.

(*a*) Nantes to St. Nazaire (Paris-Orléans Railway).

(*b*) Seventy-one kilometers (44 miles).

(*c*) The transportation charge per 1,000 kilos (2,204 pounds) for a shipment of 5,000 kilos (11,020 pounds) is 4 francs ($0.77), making for 5,000 kilos (11,020 pounds) 20 francs ($3.85), and bringing the cost of freight per 2,204 pounds per mile to $0.010.

(*d*) (*e*) (*f*) (*g*) As given in example No. 4.

*Comparative table of cost of freight per kilometric ton and per different distances for shipments of grain.*

| Termini. | Distance. | | Cost of freight per 2,204 pounds. | | Cost of freight per 2,204 pounds. | Rate based on minimum shipments for— |
|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Francs. | U. S. currency. | | |
| État Railway: | | | | | | *Kilos.* |
| Nantes–Cholet | 60 | 37 | 3.40 | $0.65 | $0.017 | 4,000 |
| Nantes–Pornic | 50 | 31 | 3.05 | .58 | .018 | 4,000 |
| Paris–Orléans Railway: | | | | | | |
| Nantes–Tours | 196 | 121 | 7.00 | 1.35 | .011 | 5,000 |
| Nantes–Angers | 88 | 55 | 4.50 | .86 | .015 | 5,000 |
| Nantes–St. Nazaire | 71 | 44 | 4.00 | .77 | .010 | 5,000 |
| État and Paris–Orléans Railway: | | | | | | |
| Pornic–St. Nazaire | 121 | 74 | 7.05 | 1.27 | .017 | 4,000 |

## QUESTION III—RATES ON FREIGHT FOR EXPORT.

The following examples will illustrate the special concessions made on certain products intended for export, namely, potatoes, lime, stone, coal, ore, and different grades of lumber:

| Termini. | Distance. | | Ordinary rates per 2,204 pounds. | | Special rates granted to export business per 2,204 pounds. | | Cost of freight per 2,204 pounds per mile. | |
|---|---|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Francs. | U. S. currency. | Francs. | U. S. currency. | Ordinary rates. | Special rates. |
| État Railway: | | | | | | | | |
| Nantes–Cholet, shipment of potatoes, per 8,000 kilos (17,632 pounds) | 60 | 37 | 3.40 | $0.65 | 3.25 | $0.62 | $0.017 | $0.016 |
| Angers–Nantes, shipment of lime and stone, per 8,000 kilos | 88 | 55 | 3.25 | .62 | 2.00 | .38 | .011 | .007 |
| Paris–Orléans Railway: | | | | | | | | |
| Angers–Nantes, shipment of cement, per 8,000 kilos (17,632 pounds) | 88 | 55 | 3.25 | .62 | 2.00 | .38 | .011 | .007 |

The terminal charge and the transportation charge are not combined. Potatoes and cement are loaded in closed cars. Lime and stone are loaded on open cars. These special rates granted to export business exist only for certain kinds of goods.

### COMPARING SPECIAL EXPORT RATES WITH SPECIAL LOCAL RATES.

*Coal shipped in carloads of 10,000 kilos (22,040 pounds), P. L. M. Railway.*

| Termini. | Kilometers. | Miles. | Special local rates, per ton. | | Special export rates, per ton. | |
|---|---|---|---|---|---|---|
| | | | Francs. | U. S. currency. | Francs. | U. S. currency. |
| Montceau-les mines to Geneva | 299 | 186 | 11.25 | $2.17 | 9.50 | $1.83 |
| Montceau-les mines to Marseille | 504 | 313 | 13.75 | 2.65 | 9.50 | 1.83 |

In the above special local rates, there is a terminal charge of 25 centimes (5 cents) per ton to be added. The special export rates given in the above table apply only to coal shipped direct from the mine and include the terminal charge. For special local rates and special export rates the loading and unloading is done by the shipper and consignee.

*Iron ore in carloads of 10,000 kilos (22,040 pounds).*

| Termini. | Kilometers. | Miles. | Special local rates, per ton. | | Special export rates, per ton. | |
|---|---|---|---|---|---|---|
| | | | Francs. | U. S. currency. | Francs. | U. S. currency. |
| Draguignan-Marseille | 154 | 97 | 5.10 | $0.98 | 3.50 | $0.68 |

Including terminal charge. Loading and unloading to be done by the shipper and the consignee.

*Freestones, slightly dressed, in carloads of 5,000 kilos (11,020 pounds).*

| Termini. | Kilometers. | Miles. | Special local rates, per ton. | | Special export rates, per ton. | |
|---|---|---|---|---|---|---|
| | | | Francs. | U. S. currency. | Francs. | U. S. currency. |
| Bellegarde-Marseille | 442 | 275 | 13.05 | $2.52 | 10.50 | $2.03 |

The expenses of loading, unloading and terminal charge are included in the rates given in the above table.

*Lumber, Bois de baraquement (lumber in logs) in carloads of 4,000 kilos (8,816 pounds)*

| Termini. | Kilometers. | Miles. | Special local rates, per ton. | | Special export rates, per ton. | |
|---|---|---|---|---|---|---|
| | | | Francs. | U. S. currency. | Francs. | U. S. currency. |
| (A) Lyon-Marseille | 352 | 219 | 21.60 | $4.17 | 10.80 | $2.08 |

*Madriers de noyer (thick walnut planks) in shipments of 5,000 kilos (11,020 pounds).*

| Termini. | Kilometers. | Miles. | Special local rates, per ton. | | Special export rates, per ton. | |
|---|---|---|---|---|---|---|
| | | | Francs. | U. S. currency. | Francs. | U. S. currency. |
| (B) Lyon-Marseille | 352 | 219 | 18.80 | $3.63 | 10.80 | $2.08 |

*Bois de charpente, autres (all other kinds of lumber) in shipments of 5,000 kilos (11,020 pounds).*

| Termini. | Kilometers. | Miles. | Special local rates, per ton. | | Special export rates, per ton. | |
|---|---|---|---|---|---|---|
| | | | Francs. | U. S. currency. | Francs. | U. S. currency. |
| (C) Lyon-Marseille | 352 | 219 | 13.55 | $2.61 | 10.80 | $2.08 |

Loading and unloading to be done by the shipper and the consignee respectively; 40 centimes (8 cents) per ton to be added to the rates in the above tables marked (A) (B) (C), for terminal charges. Fertilizers and grain are rarely exported from this country, so no export rates are given for those commodities.

## QUESTION IV.—RATES CHARGED BY DIFFERENT RAILWAYS ON HIGHEST GRADE OF FREIGHT.

Ten illustrations of rates charged by different railway lines for different distances on the highest grade of freight (that which in many countries corresponds to the express business of the United States), are afforded in the following table, which gives the transportation charge for express carriage of basket ware on French railways. This is the article taking the highest rate, at "grande vitesse," a term which is best translated into English as "by express." In fixing this rate, charges include carriage from station to station, together with all terminal charges of every kind and the cost of loading and unloading. For the sake of accurate comparisons the same routes used in other tables have been applied to this example.

*Highest rates, express service on basket ware—(rate per ton).*

| Termini. | Distance in miles. | Rate. | | Covered by rate. |
|---|---|---|---|---|
| | | Francs. | U. S. currency. | |
| Havre-Paris | 142 | 107.85 | $20.82 | All charges. |
| Cherbourg-Paris | 230 | 170.10 | 32.83 | Do. |
| Brest-Paris | 388 | 261.70 | 50.51 | Do. |
| Marseille-Paris | 536 | 341.25 | 65.86 | Do. |
| St. Nazaire-Paris | 307 | 200.70 | 38.74 | Do. |
| Dieppe-Paris | 125 | 80.85 | 15.60 | Do. |
| Dunkirk-Paris | 189 | 142.35 | 27.47 | Do. |
| St. Etienne-Lyon | 36 | 30.10 | 5.81 | Do. |
| Marseille-Lyon | 217 | 156.60 | 30.22 | Do. |
| Rouen-Paris | 87 | 66.45 | 12.83 | Do. |

Sometimes on account of urgent circumstances grain and fertilizers are shipped by fast freight, and the following examples will show the difference between fast and ordinary freight rates for those classes of merchandise.

| Termini. | Distance in miles. | Rate per ton, fast freight. | | Rate per ton, ordinary freight. | |
|---|---|---|---|---|---|
| | | Francs. | U. S. currency. | Francs. | U. S. currency. |
| *Shipments of grain.* | | | | | |
| État Ry.: | | | | | |
| Mantes-Cholet | 37 | 17.35 | $3.37 | 4.20 | $0.81 |
| Paris-Orléans Ry.: | | | | | |
| Nantes-Tours | 121 | 47.10 | 9.09 | 13.10 | 2.52 |
| Nantes-Angers | 55 | 22.60 | 4.36 | 6.50 | 1.25 |
| *Shipments of fertilizers.* | | | | | |
| État Ry.: | | | | | |
| Nantes-Cholet | 37 | 17.35 | 3.37 | 5.70 | 1.10 |
| Paris-Orléans Ry.: | | | | | |
| Nantes-Tours | 121 | 47.10 | 9.09 | 9.85 | 1.90 |
| Nantes-Angers | 55 | 22.60 | 4.36 | 5.50 | 1.06 |

QUESTION V.—ILLUSTRATIONS OF RATES CHARGED BY DIFFERENT RAILWAYS FOR DIFFERENT DISTANCES ON TYPICAL PRODUCTS, SHOWING BOTH CARLOAD AND LESS THAN CARLOAD RATES.

*Comparative table of rates per fraction of carload and per full carload, for different distances, for shipments of lumber, fertilizers, and grain.*

| Termini. | Distance in miles. | Rates per 1,000 kilos (2,204 pounds) for 500 kilos (1,102 pounds), part of carload. | | Rates per 1,000 kilos (2,204 pounds) for 4,000 kilos (8,816 pounds), full carload. | |
|---|---|---|---|---|---|
| | | Francs. | U. S. currency. | Francs. | U. S. currency. |
| *Shipments of lumber.* | | | | | |
| État Ry.: | | | | | |
| Nantes-Cholet | 37 | 8.05 | $1.55 | 3.40 | $0.65 |
| Paris-Orléans Ry.: | | | | | |
| Nantes-Tours | 121 | 16.20 | 3.12 | 6.00 | 1.15 |
| Nantes-Angers | 55 | 6.50 | 1.25 | 3.00 | .57 |
| *Shipments of fertilizers.* | | | | | |
| Paris-Orléans Ry.: | | | | | |
| Nantes-Cholet | 37 | 5.70 | 1.10 | 3.15 | .60 |
| Nantes-Tours | 121 | 9.85 | 1.90 | 5.45 | 1.05 |
| Nantes-Angers | 55 | 5.50 | 1.06 | 3.75 | .72 |
| *Shipments of grain.* | | | | | |
| Paris-Orléans Ry.: | | | | | |
| Nantes-Cholet | 37 | 6.35 | 1.22 | 3.40 | .65 |
| Nantes-Tours | 121 | 13.10 | 2.52 | 7.00 | 1.35 |
| Nantes-Angers | 55 | 6.50 | 1.25 | 4.50 | .86 |

The following condensed table shows the rates charged for the transportation of domestic animals, except horses, by the Paris, Lyon and Mediterranean Railway:

*Freight rates for domestic animals.*

| Distance in— | | Oxen, cows, bulls, horses, mules, donkeys, colts, per animal. | | Calves and pigs, per animal. | | Sheep, lambs, goats, per animal. | |
|---|---|---|---|---|---|---|---|
| Kilometers. | Miles. | Francs. | U. S. currency. | Francs. | U. S. currency. | Francs. | U. S. currency. |
| 6 | 3¾ | 1.95 | $0.38 | 0.75 | $0.14 | 0.40 | $0.08 |
| 7 | 4⅜ | 2.10 | .40 | .80 | .15 | .40 | .08 |
| 8 | 5 | 2.30 | .44 | .90 | .17 | .45 | .09 |
| 9 | 5½ | 2.45 | .47 | .95 | .18 | .45 | .09 |
| 10 | 6¼ | 2.60 | .50 | 1.00 | .19 | .50 | .10 |
| 11 | 6¾ | 2.75 | .53 | 1.05 | .20 | .55 | .106 |
| 12 | 7½ | 2.90 | .56 | 1.10 | .21 | .55 | .106 |
| 13 | 8 | 3.10 | .60 | 1.20 | .23 | .60 | .115 |
| 14 | 8¾ | 3.25 | .63 | 1.25 | .24 | .60 | .115 |
| 15 | 9⅜ | 3.40 | .66 | 1.30 | .25 | .65 | .125 |
| 16 | 10 | 3.55 | .68 | 1.35 | .26 | .70 | .135 |
| 17 | 10½ | 3.70 | .71 | 1.40 | .27 | .70 | .135 |
| 18 | 11¼ | 3.90 | .75 | 1.50 | .29 | .75 | .144 |
| 19 | 11⅞ | 4.05 | .78 | 1.55 | .30 | .75 | .144 |
| 20 | 12½ | 4.20 | .81 | 1.60 | .31 | .80 | .154 |
| 500 | 311 | 81.00 | 15.63 | 30.40 | 5.87 | 15.20 | 2.94 |
| 1,000 | 621 | 161.00 | 31.07 | 60.40 | 11.66 | 30.20 | 5.83 |

RATES AND CONDITIONS OF SHIPMENT FOR ARMOR PLATE OVER EACH OF THE SEVEN TRUNK RAILWAY SYSTEMS.

*Special Tariff No. 29.*—(Nord and Orléans lines.) For shipments of heavy and bulky freight, the rates are applied on 10 tons. All weight in excess of 10 tons is doubled. Example of the application of this regulation: For a shipment weighing, say 12 tons, the excess in this case is 2 tons, which is doubled, hence the rates are applied on 14 tons according to the nature of the merchandise.

*Special Tariff No. 129.*—(Applies to the following railway lines: L'Est, État-Midi, Nord, Orléans, Ouest, and P. L. M.) Shipments of heavy and bulky freight are accepted if the length does not exceed 7.50 meters (22.50 feet), or 6.50 meters (19.50 feet), the limit for the Midi, Chemin de Fer de l'État, and Belt lines, and on the condition that the weight of such shipment is over 10 tons and does not exceed 40 tons.

These divers tariffs, whether general, special, interior, or common, exact 10 tons as a basis of shipment, and all weight in excess of 10 tons is doubled. Below follow examples of the application of these rates over seven different railway lines:

*Eastern Railway, Special Tariff No. 14, Table G.*—For a shipment of 14 tons of armor plate (18 tons charged for), terminal charges included: Belfort to Paris, 442 kilometers (275 miles), 12.25 francs ($2.36) per ton.

*State Railway, Special Tariff No. 14, Table 6.*—For a shipment of 11 tons of armor plate (12 tons charged for), terminal charges included: Poitiers to Rochefort, 142 kilometers (88 miles), 7.40 francs ($1.31) per ton.

*Southern Railway, Special Tariff No. 14, Table C.*—For a shipment of 18 tons of armor plate (26 tons charged for), terminal charges included: Cette to Bordeaux, 482 kilometers (299 miles), 20.50 francs ($3.96) per ton; Toulouse to Bordeaux, 257 kilometers (160 miles), 15.85 francs ($3.06) per ton.

*Northern Railway, Special Tariff No. 14, Table H.*—For a shipment of 21 tons of armor plate (32 tons charged for), terminal charges included: Paris to Dunkirk, 267 kilometers (166 miles), 8 francs ($1.54) per ton.

*Orleans Railway, Special Tariff No. 14, Paragraph I.*—For a shipment of 25 tons of armor plate (40 tons charged for): Paris to Lorient, 615 kilometers (382 miles), 27 francs ($5.21) per ton.

*Western Railway, Special Tariff No. 14, Series 6.*—For a shipment of 30 tons of armor plate (50 tons charged for), terminal charges included: Paris to Cherbourg, 369 kilometers (229 miles), 14.45 francs ($2.79) per ton.

*Paris, Lyon and Mediterranean Railway; Special Tariff No. 14, Paragraph VIII.*—For a shipment of 31 tons of armor plate (52 tons charged for): Creusot to Marseille, 504 kilometers 313 miles), 14 francs ($2.70) per ton.

The freight rates are based on distance. There are special tariffs which for a certain distance cause a decrease in the cost of the kilometric ton.

Example: For a shipment of grain to a distance beyond 600 kilometers (373 miles) the cost of the kilometric ton falls to 0.01 franc per kilometer.

For a shipment of oil to a distance beyond 875 kilometers (543 miles) the cost of the kilometric ton is lowered to 0.01 france per kilometer.

### FREIGHT RATES ON VARIOUS MANUFACTURES OF METALS.

In addition to the foregoing specialized data the following special analysis of rates charged by the Paris, Lyon and Mediterranean Railway for the transportation of the whole list of iron and steel ingots, rails, beams, girders, castings, railway supplies, springs, etc., has been contributed by Consul Hunt, of St. Etienne.

Metals coming from blast furnaces and steel works are divided into four different classes as follows:

#### COMMON TARIFF NO. 114, CHAPTER I.

(A) Raw steel or iron composed of ingots or puddled iron for rolling, iron alloys in ingots or scrap, waste steel, wrought or cast iron, and crude iron in ingots or wedges.

#### COMMON TARIFF NO. 114, CHAPTER VII.

(B) Steel in bars, rolls, plate, flat or platina, crude steel or cast iron, hoop steel, rolled iron, or steel in bundles or rims, special iron or steel moldings, fish plates for rails, sheet iron in cases, pieces of steel or iron not previously provided for elsewhere, frames or constructions of steel, girders, beams, and rails, sheet iron or steel of a thickness of 0.03937 inch, unfinished sheet iron or steel packed in cases, and iron railway sleepers.

#### COMMON TARIFF NO. 114, CHAPTER XXVII.

(C) Steel car springs, nuts and bolts, iron castings, machine parts finished or unfinished, steel turning platforms, coarse or sheet lead, steel or iron nails, new or second-hand rails, locomotive and car springs, and buffers, rivets, car wheels, steel or iron rims, nobs or plates, screw rings for rails, sheet metals boxed or crated, iron tubes, zinc in sheets or pieces.

#### COMMON TARIFF NO. 114, CHAPTER XXXIX.

(D) Steel or iron tires, hoop iron, iron retorts, rail chairs, fish plates and bolts, sleepers and supports and other metals used in laying rails, galvanized or plain iron or steel wire and iron weights.

Such are the different categories of metals under the tariff rates applicable to their transportation in France. Example showing the application on shipments under these divers rates.

Special Tariff No. 14, Chapter IX is applied on shipments of crude steel or iron, in ingots or puddled iron, cast-iron in ingots, and on all other kinds of metals named under A and B above:

For a distance of 114 kilometers (71 miles) the freight rates on this class of metals would be 4.40 francs ($0.84) per ton for a minimum

shipment of 5 tons. For instance, from Givors to Digoin, 180 kilometers (112 miles), 6 francs ($1.15) per ton; from Paris to Fourchambault, 246 kilometers (153 miles), 7 francs ($1.35) per ton; from Chasse to Fraisans, 254 kilometers (158 miles), 7.50 francs ($1.44) per ton.

From any depot to any other depot:

| Distance. | | Rate per ton. | |
|---|---|---|---|
| Kilometers. | Miles. | Francs. | U. S. currency. |
| 200 | 124 | 7.40 | $1.33 |
| 600 | 373 | 15.40 | 2.97 |
| 1,100 | 683 | 22.90 | 4.42 |

Application of these rates per ton between different points: Paris to St. Etienne, 500 kilometers (311 miles) 13.40 francs ($2.58); Paris to Firminy, 506 kilometers (314 miles), 15.40 francs ($2.97); Marseille to Firminy, 360 kilometers (224 miles), 11.60 francs ($2.24); Cette to Firminy, 372 kilometers (231 miles), 11.75 francs ($2.27).

SPECIAL TARIFF NO. 14, CHAPTER XIX.

Shipments consisting of steel or iron tires, car springs, locomotive and car wheels, steel cars (in parts or put together), pay the rates on a minimum carload of 10 tons.

From any depot to Paris (including terminal charge of $0.07 per ton): For a distance of 100 kilometers (62 miles), 5.40 francs ($1.04) per ton. For each additional kilometer there is a charge of $0.005 per kilometer. For a distance of 200 kilometers (124 miles), 8.40 francs ($1.62) per ton. For each additional kilometer, $0.004 per kilometer. For a distance of 300 kilometers (186 miles), 10.90 francs ($2.10) per ton. For each additional kilometer, $0.002 per kilometer. For a distance of 400 kilometers (248 miles), 12.40 francs ($2.39) per ton. For each additional kilometer, $0.001 per kilometer. For a distance of 800 kilometers (497 miles), 16.40 francs ($3.16) per ton. For a distance of 1,100 kilometers (683 miles), 19.40 francs ($3.74) per ton.

In the following examples all charges are included in the prices given:

| Termini. | Distance. | | Rate per ton. | |
|---|---|---|---|---|
| | Kilometers. | Miles. | Francs. | U. S. currency. |
| St. Etienne-Paris | 500 | 311 | 13.40 | $2.58 |
| Firminy-Paris | 506 | 314 | 13.45 | 2.59 |
| Marseille-Paris | 826 | 513 | 16.65 | 3.21 |
| Cette-Paris | 780 | 485 | 16.20 | 3.12 |
| Creusot-Paris | 349 | 217 | 11.65 | 2.25 |

Besides the above tariff there exist fixed rates on shipments of 50 kilograms (110 pounds) to Paris and vice versa. The following metals are included under these rates:

Tires, fish plates, rail chairs, screw rings for posing rails, waste copper, brass and bronze, piece iron or steel for construction purposes,

beams and girders, locomotive wheels, sheet iron or steel (at least 0.03937 inch thick), sheet iron galvanized, grooved, tinned, zincked, or corrugated. The fixed rates applicable on such shipments are found under series 5 of Special Tariff No. 14, Chapter XIX.

SPECIAL TARIFF NO. 14, PARAGRAPH 11.

Under paragraph 11, the maximum distance for shipments is 522 kilometers (324 miles). Below follow a few examples of the application of these rates under four categories of paragraph 11:

First category, from Paris and vice versa to: Pont du Navoy, Syam, Chasse, Givors, Vienne, 35 francs ($6.75) per ton.

Second category, from Paris and vice versa to: St. Etienne, Port Salamon, or Couzon, 27 francs ($5.21) per ton.

Third category, from Paris and vice versa to: St. Bonnet le Chateau, Bas Monistrol, 24 francs ($4.63) per ton.

Fourth category, from Paris and vice versa to: Grandvillars or St. Hippolyte, 18 francs ($3.47) per ton.

Under the same paragraph are given other rates for a maximum distance of 593 kilometers (368 miles). Below is found an example of the application of such rates:

From Paris and vice versa to: Le Cheylas la Bussiere to Tullins-Fures, 20 francs ($3.86) per ton.

COMMON TARIFF NO. 114, CHAPTER I.

The rates given in this tariff cover shipments over all French railway lines, and are applicable to the kind of metals named under "A" above. They cover a minimum carload of 10 tons. The minimum distance for shipments under this tariff is 400 kilometers (248 miles) for the Chemin de Fer de l'Est (Eastern Railway) and 300 kilometers (186 miles) over the Paris, Lyon and Mediterranean.

Examples of the application of these rates for different distances over the P. L. M. and l'Est (the terminal charges of $0.07 per ton are included):

A distance of 300 kilometers (186 miles), 9.40 francs ($1.81) per ton (extra charge of $0.003 for each additional kilometer); a distance of 600 kilometers (373 miles), 15.40 francs ($2.97) per ton (extra charge of $0.002 for each additional kilometer); a distance of 1,000 kilometers (621 miles), 21.40 francs ($4.13) per ton; a distance of 1,400 kilometers (870 miles), 27.40 francs ($5.29) per ton.

Examples of the application of these rates over different railways for different distances:

ORLEANS AND MIDI RAILWAYS.

| Termini. | Distance. | | Rate per ton. | |
|---|---|---|---|---|
| | Kilometers. | Miles. | Francs. | U. S. currency. |
| Bordeaux-Bourgoin | 623 | 387 | 15.75 | $3.04 |
| Bordeaux-Rives | 649 | 403 | 16.15 | 3.11 |
| Boucau-Rives | 853 | 530 | 19.20 | 3.70 |
| Bordeaux-Voiron | 663 | 412 | 16.35 | 3.15 |
| Bordeaux-Grenoble | 685 | 426 | 16.70 | 3.22 |
| Trompeloup-Voiron | 721 | 448 | 19.30 | 3.72 |
| Trompeloup-Grenoble | 743 | 462 | 19.65 | 3.79 |

L'EST, MIDI AND P. L. M. CONNECTIONS.

| Termini. | Distance. | | Rate per ton. | |
|---|---|---|---|---|
| | Kilometers. | Miles. | Francs. | U. S. currency. |
| Auboue-Terrenoire | 532 | 331 | 14.05 | $2.71 |
| Frouard-St. Etienne | 466 | 289 | 12.70 | 2.45 |
| Homecourt-St. Etienne | 537 | 338 | 14.15 | 2.73 |
| Longwy-St. Etienne | 583 | 362 | 15.05 | 2.90 |
| Pont à Mousson-St. Etienne | 484 | 300 | 13.05 | 2.52 |
| Ria-St. Etienne | 552 | 343 | 14.45 | 2.79 |

Rates applicable to the kind of metals named under "B" above, on carloads of 10 tons. Examples of application of tariff for a minimum distance of 500 kilometers (311 miles):

A distance of 500 kilometers (311 miles), 20.40 francs ($3.94) per ton (extra charge of $0.003 for each additional kilometer); a distance of 600 kilometers (373 miles), 22.90 francs ($4.42) per ton (extra charge of $0.002 for each additional kilometer); a distance of 1,300 kilometers (808 miles) 33.40 francs ($6.44) per ton (plus terminal charge of $0.07 per ton).

Taking the above rates as a basis, below follow examples of their application over different railway lines according to Common Tariff No. 114, Chapter VII:

| Termini. | Distance. | | Rate per ton. | |
|---|---|---|---|---|
| | Kilometers. | Miles. | Francs. | U. S. currency. |
| Berguette-St. Etienne | 760 | 472 | 25.25 | $4.87 |
| Berguette-Firminy | 765 | 475 | 25.40 | 4.90 |
| Champigneulles-St. Etienne | 469 | 291 | 20.40 | 3.93 |
| Eureville-Clapier | 434 | 270 | 20.40 | 3.93 |
| Douai-St. Etienne | 743 | 461 | 24.80 | 4.78 |
| Homecourt-St. Etienne | 537 | 338 | 21.35 | 4.12 |
| Hautmont-Terrenoire | 683 | 424 | 24.15 | 4.66 |
| Lourches-St. Chamond | 717 | 445 | 24.65 | 4.75 |
| Mont St. Martin-Chambon | 598 | 371 | 22.80 | 4.40 |
| St. Amand (Nord)-St. Etienne | 723 | 449 | 24.75 | 4.77 |
| Sous-le-Bois-La Ricamarie | 698 | 434 | 24.35 | 4.70 |
| St. Dizier-St. Etienne | 441 | 274 | 20.40 | 3.93 |
| Villerupt-Bellevue | 580 | 360 | 22.40 | 4.32 |
| Valenciennes-St. Etienne | 711 | 442 | 24.60 | 4.74 |

Below are given examples of the application of the tariff rates on the class of metals given under "C." These rates apply to shipments over the Orléans, State, and the P. L. M. lines:

COMMON TARIFF No. 114, CHAPTER XXVII.

The rates apply on shipments of 50 kilograms (110 pounds), 5 and 10 tons, respectively, in the order given; the last two items covering 10-ton shipments:

| First class. | | Second class. | | Third class. | | Distance. | |
|---|---|---|---|---|---|---|---|
| Francs. | U. S. currency. | Francs. | U. S. currency. | Francs. | U. S. currency. | Kilometers. | Miles. |
| 19.00 | $3.66 | 19.00 | $3.66 | 15.50 | $2.99 | 200 | 124 |
| 24.50 | 4.73 | 23.00 | 4.44 | 19.50 | 3.76 | 300 | 186 |
| 40.00 | 7.72 | 32.50 | 6.27 | 31.50 | 6.08 | 600 | 373 |
| 61.00 | 11.77 | 47.50 | 9.16 | 47.50 | 9.16 | 1,100 | 683 |

| Fourth class. | | Fifth class. | | Sixth class. | | Distance. | |
|---|---|---|---|---|---|---|---|
| Francs. | U. S. currency. | Francs. | U. S. currency. | Francs. | U. S. currency. | Kilometers. | Miles. |
| 15.00 | $2.89 | 8.75 | $1.69 | 10.75 | $2.07 | 200 | 124 |
| 18.00 | 3.47 | 12.00 | 2.31 | 10.75 | 2.07 | 300 | 186 |
| 26.50 | 5.11 | 21.00 | 4.05 | 16.75 | 3.23 | 600 | 373 |
| 39.00 | 7.52 | 33.50 | 6.46 | 26.75 | 5.16 | 1,100 | 683 |

To the rates given in the above tables the following terminal charges are to be added: $0.28 per 50 kilos, $0.19 per 5 tons. For 10-ton shipments, $0.07 per carload, classes 5 and 6, only.

Taking the tables as a base, spring steel for cars comes under class 2 for shipments of 50 kilograms to 5 tons. Bolts come under class 1 for shipments of 50 kilograms to 5 tons.

Cast iron falls under class 1 for shipments of 50 kilos, and under class 4 for shipments of 5 tons.

Pieces of forged steel or iron for construction come under class 3, for shipments of 50 kilos to 5 tons.

Turning tables or platforms come under class 1 for shipments of 50 kilograms and class 4 for 5 tons.

Locomotive springs fall under class 1 for shipments of 50 kilograms and class 2 for 5 tons.

Locomotive wheels come under class 1 for shipments of 50 kilograms and class 4 for 5 tons.

Sheet steel or iron packed in cases comes under class 3 for shipments of 50 kilograms and class 4 for 5 tons.

Zinc, coarse or in sheets, comes under class 1 for shipments of 50 kilograms and class 4 for 5 tons.

In order to benefit by the rates above, it is necessary to fulfill the conditions with regard to the minimum distance.

FIXED RATES.

The following are the fixed freight rates on metals for different distances over different railways:

*Orléans Railway.*—From Imphy to La Rochelle, 436 kilometers (270 miles), 19 francs ($3.66) per ton.

*P. L. M. Railway.*—From Imphy to Rochefort, 425 kilometers (264 miles), 19 francs ($3.66) per ton.

*Orleans and P. L. M. Railway.*

| Termini. | Distance. | | Rate per ton. | |
|---|---|---|---|---|
| | Kilometers. | Miles. | Francs. | United States currency. |
| Imphy-Angers | 334 | 207 | 14.50 | $2.80 |
| Imphy-Bordeaux | 517 | 321 | 20.50 | 3.95 |
| Imphy-Nantes | 422 | 262 | 16.50 | 3.18 |
| Imphy-St. Nazaire | 486 | 302 | 19.00 | 3.66 |
| St. Etienne-La Rochelle | 619 | 385 | 22.00 | 4.25 |
| St. Etienne-Rochefort | 595 | 370 | 22.00 | 4.25 |
| St. Etienne-Tonnay-Charente | 589 | 366 | 22.00 | 4.25 |
| St. Etienne-Bordeaux | 533 | 311 | 20.00 | 3.86 |
| St. Etienne-Le Mans | 535 | 332 | 20.00 | 3.86 |
| St. Etienne-Nantes | 632 | 393 | 23.00 | 4.44 |

The same rates are applicable to the list of metals given under "D."

QUESTION VI.—FREIGHT RATES BASED ON DISTANCE.

Freight rates are based absolutely on distance, and the rate per ton-mile is less for longer distances, the fall taking place per each 100 kilometers. Fractions of 100 kilometers benefit by the reduced rate. For example: Supposing wine to be rated at 7 francs for the first 100 kilometers, and 3 francs for the second, shipments for 200 kilometers would pay 13 francs and shipments for 110 kilometers would pay 7 francs plus the pro rata rate for 10 kilometers, thus:

| | Francs. |
|---|---|
| For 100 kilometers | 7.00 |
| For 10 additional at 6 francs per hundred rate | .60 |
| For 110 kilometers | 7.60 |

Thus, in reckoning French railway rates, take the total distance to be covered and compute it per 100 kilometers with the assistance of the table of government standards.

The latest edition of the official volume, Statistics of the French Railways, showing the traffic of 1907, and the situation of the various lines at the close of that year will confirm and further elaborate many of the statistics and statements which are embodied in the preceding pages of this report.

## Chapter II.

### NAVIGABLE RIVERS AND CANALS IN FRANCE.[a]

The complete system of canals and navigable rivers in France is shown by a folding map "Carte des Rivières Navigables et des Canaux exécutés, en Construction et Projetés," Paris, 1906. The development of the inland waterway systems of this country was begun in the early part of the seventeenth century—more than two hundred years before the era of railway transportation. From 1604 to 1624 the first summit-level canal, now known as the Canal de Briare, connecting the rivers Seine and Loire, was built. The network was gradually extended and improved during the eighteenth century, and in 1835 the first movable weirs were introduced for the canalization of rivers, The laws of 1879, devised by M. de Freycinet, minister of public works. standardized the cross section of the canals and the size of the locks and provided funds for the further unification of the system. This general programme was supplemented by the act of 1903, which authorized the construction of new canals and the improvement of those already in use.

With the exception of about 254 kilometers of canals belonging to municipalities and private corporations, all canals in France have been the property of the state since 1897, which was the year in which the government purchased and took over the lateral canal of the Garonne and the Midi. The canals remaining in private possession are:

| | Kilometers. |
|---|---|
| The Canal de Graves | 10 |
| The Canal de Lunel | 9 |
| The Canal de l'Ourcq | 108 |
| The Canal de St. Denis | 7 |
| The Canal de St. Martin | 5 |
| The Canal de d'Aire | 3 |
| The Canal de du Bourguidon | 11 |
| The Canal de St. Dizier and Wassey | 23 |
| The Canal de la Sambre à l'Oise | 67 |
| The Canal de Sylvereal | 9 |
| The Canal de la Souchez | 3 |
| Total (159 miles) | 255 |

According to present statistics there are in France about 5,562 miles of navigable rivers and 3,050 miles of canals. The average cost of building canals has been about 170,000 francs per kilometer, which would be approximately $52,496 per mile.

Although there prevails here as well as in other countries a certain hostility on the part of those interested in railway development to further appropriations for waterway improvement, the fact has been generally recognized that the railways can not supplant the canals and rivers for the transport of heavy, coarse freights, and that

[a] See page 4 Chap. II, for the questions answered in this chapter.

the relief of the railroads from superabundant bulk traffic must continue to be the principal function of inland navigation. Laws were enacted to prevent undue competition and every precaution taken to conserve the proper rights and privileges of the waterways.

While there have been some cases in which cities, Departments, chambers of commerce, etc., have contributed outright money for canal and waterway improvements, such instances have been rare. The general principle is that these bodies subscribe as a rule one-half the money required for the construction of new works, the other half being provided by the state. But the Government gives them the privilege of levying tolls on the traffic over the new construction to reimburse themselves for the funds, principal, and interest so advanced. These tolls, for which a maximum rate is fixed by law, are calculated in accordance with actuary tables based on probable traffic over the new work and a given length of time for paying off the debt, including interest. As soon as the debt and interest are paid, the right to collect tolls ceases and is not renewed. The Government exercises care that no Department shall thus subscribe a sum beyond its normal ability to pay. A chamber of commerce or other corporate body may negotiate a loan to provide its contribution to such an improvement which is approved and undertaken by the state.

While this provision for municipal, departmental, and corporate assistance in canals and waterway improvements is valuable in certain respects, the fact remains that down to 1900 the canals of France were built almost entirely by the state. For example, during the period from 1879 to 1900, inclusive, out of a total expenditure of 365,000,000 francs ($70,445,000) for new canals, interested cities, departments, and corporations furnished only 3,760,000 francs ($725,680), or about 1 per cent. The sums advanced to the state during the same period for such purposes and afterwards reimbursed, with or without interest, amounted to 23,500,000 francs ($4,535,500), or about 6 per cent of the whole amount expended. The total expenditure for construction, improvements, and maintenance of French waterways under government control from the year 1814 to 1900, inclusive, was as follows:

| Period. | Rivers. | Canals. | Total. |
|---|---|---|---|
| Construction and improvement, 1814 to 1900 | $128,439,471 | $180,752,259 | $309,191,730 |
| Maintenance and repairs, 1814 to 1900 | 87,741,370 | 59,925,224 | 147,666,594 |

But while interested municipal, corporate, and departmental support for the construction of new canals has in recent years been relatively unimportant, it has been largely employed for the improvement of rivers and canals already in use, and especially for seaports and harbor facilities.

This portion of the subject will be further elaborated and examples given in the proper place under topic (*b*) "Waterways improvements," in the following section of this report, which now resumes the special line of inquiry prescribed by the circular instructions of August 16.

### I. PUBLIC SUPERVISION.

(*a*) *Supervision.*—Public supervision is exercised over navigable streams and canals (as also over bridges, harbors, and quays) by the

"Administration des ponts and chaussées" (service of bridges, highways, and quays), and is carried out under the direction of the minister of public works. All persons employed in the service are government officers, who are divided into three groups: (1) Engineers, (2) inspectors, and (3) clerical force.

(*b*) *Officials and working force.*—The engineers are divided into inspectors-general of the first and second class, who constitute what is known as the general council of bridges, highways, and quays, and who, after examining into all pertinent questions of importance, render their written official opinion thereon. They are also consulted when necessary upon questions touching the construction of roads and railways. Next in rank below the inspectors-general in the engineering group are chief engineers, one of whom is in personal charge of these public works in each of the 86 Departments of the French Republic. As their subordinates they have a force of ordinary engineers, one at the head of each "arrondissement" or subdivision of the Department under the chief engineer. In turn, these subdivisional engineers have under them a corps of inferior officers and inspectors, the latter being charged with the direct surveillance and control of the laborers, with the examination of the quality of the material furnished and with the quantity of finished work delivered. The clerical force is applied to the recording and accounting branch of the work. All constructions, modifications, and improvements in navigable waters in France are executed by this service.

In the foregoing no account has been taken of any such local authority as would be implied in the right of the cities and chambers of commerce, which has already been explained, to contribute to the maintenance and improvement of waterways, such rights having no connection with the work of supervision itself.

(*c*) *Capitalization, reports, etc.*—The service of bridges, highways, and quays has no powers and duties in regard to the capitalization of navigation corporations, all of which are government enterprises pure and simple; nor in the regulation of freight rates, which is done entirely by the national legislature by its investments of authority in the minister of public works.

Reports of the operation of waterways are compiled by the ministry of public works from details supplied by the service. The maintenance and improvement of channels, docks, and terminal facilities, so far as the execution of work is concerned, are directly upon the service, the funds therefor being supplied, under government authority, by (1) the treasury of France; (2) the Department in which the work is done; (3) the city involved most directly (or the several cities so interested), and (4) the local chambers of commerce. Taking, for instance, the harbor works at Havre, the French Government has supplied 50 per cent of the necessary funds, the other half being furnished by the city treasury, by the chamber of commerce, and by the budget of the Department of Seine-Inferieur. All the work done under this appropriation is supervised by the service of bridges, highways, and quays, even when the actual laying-down of work is done by private contractors. The service disburses the available funds, accounts therefor, and enforces the faithful adherence to specifications.

2. The collection of statistics of water-borne traffic is made by the clerical force of the service, and compiled and published by the ministry of public works. The data are collected at different places on

the rivers and canals by the lock keepers, who are agents of the administration des ponts et chaussées. These agents are stationed at all points of the traffic, as much to oversee as for the handling and upkeep of the locks, docks, etc. They concentrate their reports, and consequently keep the minister of the public works, as well as the authorities of the region, departments, and localities, informed on all which concerns either the condition of the navigable ways, as well as the traffic. All boatmen and conductors of a vessel which is transporting merchandise, are obliged to make a declaration thereof at the nearest office of the ponts et chaussées, and they must indicate the nature, quantity, and destination, etc., of their merchandise. This information is compiled by the engineers who have charge of the canals and rivers, and it is finally published by the central administration at Paris.

## II. WATERWAY IMPROVEMENTS.

(*a*) It can not be said that there is as yet any definitely established, up-to-date policy in this country with respect to water powers developed by works constructed for improving navigation. Water-power concessions are regulated by articles 43, 44, and 45 of the law of April 6, 1898, and formalities for concessions are provided for by a decree dated August 1, 1905. But these regulations are regarded as crude and insufficient, and the whole subject is now under process of revision. The Chamber of Deputies at its session of July, 1909, adopted a new statute relative to water powers on public waterways, which contains provisions wholly different from those existing hitherto. The bill is now before the Senate with apparent probability of becoming a law. The enormously increased demand for water power for the generation of electricity during the past few years has been the motive behind this new legislation, which will render the present regulations obsolete and devoid of interest.

The history of French waterway improvement during the last ninety years of the nineteenth century will be shown by the official publication, entitled "Legislative acts and expenditures, concerning works of interior and maritime navigation, 1814 to 1900."

(*b*) To understand the extent to which the central Government of France has carried on river improvements and the construction of canals, it is necessary to briefly review the subject in the light of history and the progress of legislation.

The canals of France are divided into two groups, lateral and main canals. The lateral canals are those which, having a single point from which their waters are received or into which they flow, have consequently an incline in one direction. They receive their water supply from the rivers. The main canals unite or form a communication between two or several sources and run between districts of varied topographical character. Among these are the Briare Canal (the oldest in France), the Southern, the Central, one canal in Burgundy (the famous Rhine-Rhône connection), and the Rhine-Marne. From early days great importance has been attached by the French to their waterways, both canals and canalized and otherwise improved rivers, and under the reign of Henry IV (1589–1610), when their utility and value began to be specially appreciated, Sully himself was intrusted with their direction. In 1626 the royal treasurer was given

the direction of this department, a prerogative which attached to that office for many years, indeed until well down to the Revolution and the Napoleonic era.

In the earlier stages of French canal history artificial waterways and river improvements were built by private individuals, either singly or in companies organized under royal warrant for the purpose. The Crown in consideration of the great degree of public service rendered by the builders, conferred on the latter the right of collecting tolls. The canal of Languedoc, for example, was given out by royal concession in 1662 to Riquet, who associated others with him in the work of construction. The canal between Orléans and Loing, as well as the Rhine-Rhône Canal, was dug by private capital on this basis. Private capital, in fact, was found to handle these works much easier than the Crown could do it, although to economize the royal funds, troops were often put at work on the excavations. Proof of this was made clear in the reign of Louis XIII, when, in the Richelieu ministry, two contractors named Bouterons and Guyon undertook to complete the Briare Canal in four years under letters from the Crown, and on so doing received titles of nobility for themselves and their children. After this the practice of granting concessions became general. During certain reigns when the toll privileges were coveted court favorites rivaled each other for the possession of these patents.

The waterway system passed through various vicissitudes from the beginning of the Revolution until 1825, when the Government, faced with the necessity for rehabilitating the lines, but without funds in the central treasury to properly carry out such a task, confined the appropriation of tolls to the maintenance of the waterways upon which they were actually collected and allowed local chambers of commerce, city governments, or even private persons to make loans of money in certain proportionate amounts for the completion of new work. This was the origin of the system already explained, still in use, by which central and local authorities may collaborate in the improvement and construction of waterways. The early friction between them with regard to the apportioning of the amounts has disappeared as legislative processes have been refined and administrative experience has broadened; and as the Government became able to do so it bought in the concessions by paying up the construction loans, so that since 1879 practically all waterways have been directly in the hands of the central authorities at Paris and classified under the department of public works. By this means also the toll system has been abolished. The most recent purchase of a concession made by the Government was in 1897, when the lateral canal of the Garonne, the patent for which does not expire until December 31, 1960, was taken over and the advance paid up.

Under present conditions either the central Government or the local authorities, or both together, may build canals and improve waterways. A good example of canal work undertaken by local authorities alone is that of the completion of the line between the rivers Marne and Saône by the chamber of commerce of the town of St. Dizier at a cost of $965,000.

An equally pertinent example of joint action of this nature is afforded at Havre, where the new harbor works, affording the outlet facilities for the River Seine and opening the mouth of that

stream off Havre city to the entrance of the trans-Atlantic express steamers for a port of call, in place of Cherbourg, are being constructed at a cost of $16,000,000, of which $8,000,000 is appropriated by the French Government from the national treasury, while the balance is divided between the city of Havre, the Havre Chamber of Commerce, and the Department of Seine-Inferieur.

The ordinary procedure in the improvement or construction of waterways is for the local deputies representing the affected localities, or the minister of public works, when the project originates with the Government rather than in the Departments, to raise the question of an appropriation in the national legislature. Authority being given (in cases where the participation of the national treasury is required and accorded), the ministry of public works takes up the division of the cost with the local authorities, on the basis of the information brought out in the debates in the Chamber of Deputies or elsewhere. The amounts being fixed, the whole proceeding is ratified by the Government. The city authorities interested arrange for the appropriation of their share; and the chamber of commerce, which usually joins in work of this character, draws on its funds for the same purpose. This latter item is sustained by giving local chambers of commerce long-term rights in certain port and river fees, as at Havre, where the chamber has for ninety-nine years the right to fees accruing from the use of the cranes in the harbor basins for discharging cargoes. When a city government has a similar appropriation to meet, it may borrow money to carry it and reimburse itself, under warrant from the Central Government at Paris, by raising taxes in certain directions, as a supplement to the regular tax levy; or in some cases by increasing the octroi duty paid by food products and certain other articles at the city gates.

Since the passage of the law of May 3, 1841, property may be expropriated under condemnation proceedings, and owners reimbursed therefor, when canal construction or waterway improvements so demand. A decree of the ministry of public works is sufficient to authorize the building of any waterway of less than 12.6 miles in length; but waterways of greater extent can only be constructed under a special act of Parliament.

It may be of interest to the American student of the subject to note that the estimated cost of the French canal system as it stands to-day (as distinct from the river improvements) is about $125,000,000; and that this, applied to a total canal construction of approximately 3,107 miles, had to be extended over a very long period of time. The inference would appear to be that any country undertaking extensive canal works would be obliged to have either a well-equipped treasury or a prolonged history. It is good canal history in France that nearly all these works cost more than the estimates. The Tancarville Canal, from Havre to a point 15 miles up the Seine, cost $750,000 more than the first appropriation, the Havre Chamber of Commerce having contributed a million dollars toward it and the French Government $3,600,000.

The whole system of internal navigation in France includes 5,562 miles of navigable rivers and 3,050 miles of canals, besides 1,802 miles of streams which are navigable only for rafts, a total of 16,700 kilometers, or 10,377 miles. Of all these, only 250 kilometers belong to concessionaires, viz, the canal from the Sambre to the Oise, which

will revert to the state in 1937; the St. Denis Canal, 8 miles long; and the Ourcq Canal, 68 miles long, all of which belong to the city of Paris.

The cost of maintaining canals and navigable rivers, including the wages paid to officers and employees of all grades, ranges from $4,000,000 to $5,000,000 per annum.

### III. FLOATING EQUIPMENT.

(*a*) The vessels used on rivers and canals in France include steam tugs, with engines of from 100 to 800 horsepower; towboats, which operate with submerged chains; barges, lighters, and canal boats of wood, iron, and steel, both open and decked, either self-propelled or designed to be towed by men, horses, or mules. The dominant type of freight boat is the *Gabareau* or Flemish Péniche, a decked barge built generally of wood and measuring about 128 feet in length, with 16 feet beam and a draft when loaded of about 6 feet, which enables it to pass the standardized locks of the French canals at ordinary stages of water. It is an exceedingly economical craft, its dead weight being only about 15 per cent of a full cargo and its cost to build from $2,400 to $3,000. It is easily repaired and if kept painted and properly used is good for thirty years of service.

On the river Rhone the steam vessels measure about 200 feet, with 26 feet beam and a draft not exceeding 5 feet in low water. The use of wood in all forms of river craft has gradually given place in recent years to that of iron and steel, but wooden construction still prevails on most of the canals and small waterways. On the Seine steamers are in use which exceed 1,000 tons in burthen.

In response to the eight questions which are included in this section, the following answers have been compiled largely from data furnished by the American consulates at Havre, Lyon, Nantes, and Bordeaux.

(1) *Self-propelled vessels.*—The relative use of self-propelled vessels and towed vessels can not be stated in specific terms, though it is true that the very large majority of craft used in internal navigation have no power of their own. On the navigable rivers open to the sea, steamers carry the off-shore freights to the exclusion of barges; but in navigation of rivers above sea-traffic points and on canals the towed barge is in use. The use of a few self-propelled canal boats is reported, but their number is too small to be figured in any available public statistics. Within five years a French company has been organized to carry freight on inland waterways in 12 steam-propelled lighters especially built for them in one of the foremost yards of the country. The boats were stern wheelers of 4 knots speed and the engines were designed with particular regard to economy of operation. They were used in all parts of France and especially in the canal trade between Paris and Brussels.

The results of this experiment were so unfavorable that the company failed and the boats came back upon the hands of the ship building company which had laid them down. It is now reported that they are being sold in lots to other concerns, but their future is still a problem. The trials showed that they carried less freight than the towed lighter (their capacity was 280 tons each) and that their rate of speed was too low. A tugboat drawing 5 or 6 loaded

lighters was able to apply its propelling energy to an average degree so much higher than the efficiency reached in the individual steam carrier that the expected advantage disappeared entirely.

(2) *Motive power.*—Thus the question of motive power stands in France to-day. On rivers and canals with seaport or river outlets and on the larger waterways generally the towing boat is used very generally. On smaller waterways the old-fashioned horse or mule towing arrangement or in some cases man power, with sundry more or less practical efforts at mechanical towage, prevail.

The towing steamers are especially built of light draft (never more than 9 or 10 feet and frequently less), and of very great horsepower. Such steamers, for instance, carry the entire river traffic on the Seine from Havre to Paris and are designed to draw large tows of lighters against the maximum current at good speed. These tugs take as many as six large loaded barges of 700 tons each from Havre to Paris against the Seine current.

Taking French waterways as a whole it is evident that motive power remains on a somewhat primitive basis, but in special cases the most modern appliances have been placed under experiment. It is reported by Engineer F. B. DeMas, inspector-general of the service of highways, bridges, and canals, that in central France, remote from the seaboard, haulage by man power is still much used. Two men usually tow, one on each side of the canal, with ropes attached to the boat. Under such conditions steering is useless, and it is not necessary to have any crew on board. On the other hand, experience in France shows that such boats have difficulty in passing locks and that so much time is taken up in resting the crew that the apparent economy disappears rapidly in practice. The speed of hand towing in France averages about two-thirds of a mile per hour and not more than from 5 to 7 miles per day. The cost is figured at "from 5 to 7 millimes per metric ton per kilometer."

Another primitive arrangement, more effective than man power alone, is reported from the Canal du Berri, a lock canal navigated exclusively by small boats of not more than 50 to 60 tons capacity. On board of each boat there is carried a mule which is used in connection with the crew to furnish traction for the barge. This form of mixed power is reported to be in use not only on the canal in question, but has come into custom for larger draft on rivers in the Seine basin. The cost of haulage is about the same as that for man power alone, but the day's run is enough greater to considerably increase the comparative net advantage.

Horse haulage is extensively in use on the French canals north of Paris toward Calais and on waterways extending to the Belgian border. Most of it is done in relays furnished by individuals or, in some cases, by companies, which have for some time been organized for the furnishing of towing horses. On the Oise River, for example, there is reported a lateral canal 90 miles in length on which horse haulage was established by a towing company as far back as 1875. Lighters on this canal are towed with 13 relays of animals stationed at the terminals and at the locks along the course. On this canal the bargemen ordinarily contract with the towing company for haulage at a fixed price for a period of three or five years. Conditions there have been much affected by the development of steam towage on the Oise itself.

On another French canal 100 miles in length there is reported to be still in operation a regular service of horse towing in relays, established by a government decree in 1875. The course is divided into sections, each one of which is allotted under concession to a contractor who furnishes the animals. Towage under these conditions is rendered obligatory on all loaded lighters using the canal, either going up or descending, excepting only steam vessels, but is optional for barges going light. The general concessionaire has the right to adopt any other method of towage at his discretion, but up to this time horses have been used exclusively. Obviously the conditions create an absolute monopoly for the towers, who, however, are bound to take the waiting boat without delay at a speed of not less than 1.3 miles per hour, and they must lock their tows in the way best calculated to accelerate the voyage.

*Mechanical traction.*— In general, mechanical towing in France has been undertaken by the Government rather than by private persons. Many of these systems are applied only to places where special conditions, like tunnels, render the ordinary methods useless. These, indeed, are the majority. But little has been done so far in the use of "electric mules" and other appliances for general towing on inland waterways. On the St. Quentin Canal, for example, there is a section 10 miles long or more on which towing is done by an under-water chain system much like the cable railway. All vessels passing this section must be towed in that manner, about 5,000,000 tons annually passing over the point in question. From 15 to 25 boats can be taken over at one time, and as many as 35 smaller vessels have been towed. Boats on the St. Quentin Canal run in tonnage from 100 to 300 tons. Curves are turned on series of fenders planted on the convex side.

Another chain system is in use on the Marne-Rhine Canal for a distance of 5 miles, more than half of which is through tunnels. The chain is moved by steam. Boats passing over this section carry about 1,500,000 tons annually. A similar system is in use on the canal of Bourgogne for a distance of about 4 miles, nearly all in tunnels; and on this line electricity is used for the motive power. On the Aisne-Marne Canal a tunnel section of about 2 miles gives towage with the funicular system, carrying about 1,500,000 tons a year.

Experiments have been made from time to time (in 1894 on the St. Denis Canal) with electrical transmission systems, energy from power houses being carried through wire lines and delivered on board vessels through trolleys for driving individual propelling machinery. Such experiments have resulted variously. In general, it has been found that good results can be obtained only when the boat is constructed especially for the use of the propeller.

As far back as 1873 experiments were made in Burgundy with steam locomotives traveling on rails parallel to the canal. This was on the main Canal de Bourgogne, with a length of 160 miles and 189 locks. Boats were towed singly by special locomotives weighing 4 tons and equipped with special wheels to secure the required tractive effort. This experiment proved a failure, both technically and financially.

For some years, according to Engineer De Bas, a service of locomotive towing was operated upon the canals of Neifofosse, d'Aire, and the Deûle between the locks of Fontinettes and Douai. The section carried considerable traffic, and there was but one lock. Traffic was divided so that boats ascended the canal on Mondays, Wednes-

days, Fridays, and Sundays and came down on the other days of the week. Speed was not more than 1 mile an hour, and after great difficulty in towing more than one boat at a time the company went out of business in 1886.

The first French experiments in funicular towage were made in 1862. On short sections of the Aisne-Marne, St. Maur, and St. Maurice canals this system is in successful use after extended trials for discovering the best methods for handling the cables and the attaching devices. On one French canal where this towage is used a special employee goes with each tow to direct its cable connections. As reported above, this method is in use on the Aisne-Marne Canal, where it has given perfect satisfaction since 1895 over short distances. It is regarded as especially economical.

The first French experiments with the electric mule were begun in 1896, on the canal of Bourgogne. The tricycle carriage was used, taking current from an overhead wire line through a flexible conductor. Two years later, in 1898, a company was formed to introduce this form of towage on the d'Aire and Deûle canals in the north of France (at about the same time that the Belgians began their work on this line). The French company began work on a line about 40 miles long. The articles of its incorporation and of authority from the Government provided strict regulations for its procedure, covering the motive power, the number of engines and their character, the placing of wire lines, the right of way, and the required towage of five boats an hour in each direction. The speed was required to be from 1.5 to 2 miles an hour. At night the canal was to be lighted by electricity. So much doubt as to the future of electrical towage was expressed at the time that the company's rights were wholly withdrawable by the Government at any time at its discretion in the public interest, without recourse or reimbursement.

A hundred electric mules were installed in the first instance. Four power houses were built, furnishing current in the amount of 810 kilowatts from a steam plant of 1,350 horsepower. The wire line was carried on 16-foot poles along the right of way. It is reported that this system has given good results, in towing with comparatively high speed, great regularity, unusual flexibility of service, and conditions which have rendered possible a considerable reduction in the towing tariff. The Government has rendered some assistance in the rebuilding of the permanent way. Competent engineers report that this system is transporting vessels under better conditions at a price not above that for horses towing in relays.

Experiments have been undertaken from time to time with towage by petrol motors, but have so far remained undeveloped in any measurable way. There are now in use on the canals and waterways of France 284 ordinary tugs and 53 towboats, which operate with submerged chains.

(3) *Size and draft of vessels.*—As to the size and draft of vessels on French waterways, the tonnage runs from 250 to 750; draft from 6 to 8 feet; length, 95 to 200 feet; and beam from 16 to 23 feet. These measurements are covered by laws in so far as they apply to lighters and other craft for use on the internal waterways of the country. Rigid laws govern the construction and maintenance of steamers for use on rivers, with a view to giving the utmost practical degree of safety to their crews. Particular attention is paid to the

placing of the boilers and their protection, to life-preservers, medical supplies, surgical first-aid appliances, and small boats.

By the law of 1879, French canal boats may not be of dimensions greater than 130 feet in length, 16.8 feet in beam, and 6 feet in draft. There are many smaller boats, of course, while for river traffic the dimensions are governed by conditions of towing and depth of water, as well as by the character of the trade in which the boat is engaged. On the Seine, boats do not run generally over 8 feet in draft, the mean depth of the river being 10 feet. Lighters of deeper draft can be operated in tows as far as Rouen, however, though for through traffic from Havre to Paris the standard canal barges are used.

TYPE OF BOATS ON THE UPPER SEINE.

On the Upper Seine, from Paris to Montéreau, a distance of 60 miles, the floating equipment differs somewhat from that of the Lower Seine between Paris and the sea, and the following list shows the local name, length, beam, draft, and carrying capacity of the various boats which are used on the upper and shallower portions of the river:

| Type. | Length. | Beam. | Draft, loaded. | Capacity. |
|---|---|---|---|---|
| | *Feet.* | *Feet.* | *Feet.* | *Tons.* |
| Montluçons | 91.25 | 8.17 | 4.36 | 70 |
| Sapines | 33- 85.00 | 12.00 | ..... | 15- 100 |
| Berrichons | 90- 91.00 | 8.50 | 4.90- 5.00 | 90 |
| Flûtes d'Ourcq | 93.00 | 10.00 | 3.80- 4.00 | 78- 80 |
| Petit Savoyard | 82-115.00 | 18-23.00 | 4.00 | 130 |
| Chalonnais | 100.00 | 16.40 | 5.25 | 195 |
| Toues | 102-123.00 | 16.40 | 6.25 | 295 |
| Flûtes | 102- 95.00 | 16.40 | 6.25 | 230- 295 |
| Péniches-Flamandes | 113-126.00 | 16.40 | 6.90- 7.40 | 320- 380 |
| St. Dizier | 113-124.00 | 16.40 | 5.50- 6.90 | 240- 380 |
| Marnois | 131.00 | 25.30 | 4.90- 6.90 | 280- 400 |
| Chalands | 110-167.00 | 16-26.00 | 6.60-10.00 | 300- 600 |
| Grands Chalands | 173-206.00 | 26.50 | 8.40-10.60 | 950-1,000 |
| Citernes | 122.00 | 21.60 | 6.60 | 410 |
| Porteurs | 113-131.00 | 16-20.00 | 7.00- 8.00 | 230- 285 |
| Screw tugs | 80.00 | 14.00 | 5.25 | 60 |
| Paddle tugs | 125.00 | 35.30 | 5.80 | 190 |
| Toueurs (for sunken chains) | 124-138.00 | 19-23.00 | 2.00 | ..... |

On the canal between Nantes and Brest the barges are uniformly about 112 feet long, 17 feet wide, with a draft of 4 feet. These dimensions are practically identical with those of boats used for similar purposes on the canalized River Loire.

(4) *Materials of construction.*—The majority of vessels used on French waterways are of wood, taking them by number only and thus including the great fleet of old boats which are still being run after many years of service. New boats are generally built of steel, in which most of the new construction is being laid down. Wood is still used in most of the boats owned and operated by the bargeman who, with his family, lives on board and takes charters where he can get them, like the tramp steamer on deep-sea traffic.

Towing boats, excepting some old craft still in use, are generally of steel. Coal-carrying barges and oil-tank lighters are of steel.

Generally speaking, the wooden hull is gradually going out and the future inland fleets of France will be built of metal. Taken by tonnage and not by number, the greater portion to-day would probably be steel and iron hulls.

(5) *Cost of boats.*—The cost of various types of boats is from $1,900 to $9,650, referring to all classes of lighters and barges and not to towing vessels. A steel canal or river barge, for towing, of 200 tons will cost about $8,000. A wooden vessel of the same design costs 30 per cent less.

At Nantes the cost of an iron barge of the standard measurements above given, rigging included, runs from $2,900 to $3,860. A wooden barge of the same type costs from $2,122 to $2,900.

On the Rhône, where the boats are much longer than on the Seine or Loire, the steel towboats cost from $10,000 to $77,000. At Bordeaux the cost of the ordinary wooden canal boat varies from $1,600 to $2,000, and about $4,000 when made of iron

(6) *Boats of special type.*—The use of special types of boats for particular cargoes and on different classes of waterways is common in France. In the north of France coal-carrying barges have been specially constructed to navigate the canals in that part of the country. Oil carriers have been constructed with some success for that trade. Since the coal importations at Rouen began to increase rapidly some years ago a new type of carrier for that cargo has appeared, a heavy steel barge of large tonnage to be towed up the Seine by steamer, five or six in a tow.

On the Rhône the only special type of boat used for a particular cargo is the tank boat for the transportation of petroleum.

(7) *Size of fleets.*—The size of fleets of barges as carried up the rivers and canals depends upon the cargo, the character of the waterway, the size of the boats, and the capacity of the towing steamer. Ordinarily, from three to six barges are towed between Havre and Rouen on the Seine, or between Havre and Paris, this being one of the most difficult courses in France on account of the poor channel and the swift current. Sometimes between Rouen and Paris more than eight boats can be towed in the better water to be found there. On inland canals from 15 to 25 boats can be towed under good conditions, though it is to be remarked that on French canals as a whole the tendency is to tow boats singly. As more modern methods of towage come into use this will undergo a change, and is not now the case in the isolated instances where hand or animal towage has been done away with. On the Rhône an ordinary fleet towed by one steamer includes from two to eight barges.

(8) *Boats for low water.*—The type of boats is adapted to low-water stages for canal use, and for rivers to a draft depending upon the waterways to be navigated. In France, however, there is a very small margin of difference on this point, the laws already spoken of in this report bearing directly upon the dimensions and character of the vessel, and the uniformity of all the interior waterways affecting the question with much emphasis. For special uses on certain rivers, boats depart from the standard low-water types, but even then, but little; while even on the Seine, in order to get the barges straight through from Havre to Paris, the low-water type is used exclusively. This is also the case on the Rhône and Loire, where low water has to be reckoned with during several months of the year, and boats are generally built with draft ranging from 4 to 6 feet, according to the weight of cargo. It may, therefore, be stated as a principle that the equipment of French canals and waterways is uniformly of the low-water type of vessels of all classes.

## IV. OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

(*a*) *Operating companies.*—In France there are no "canal companies" or "waterway improvement companies" to own and operate vessels, all canals and improvements being under government ownership and control. There are navigation and transportation companies, which own and operate vessels on canals and rivers, but they have nothing to do with building canals or improving waterways. For example, the Compagnie Générale de Navigation, Havre-Paris-Lyon-Marseille, owns and operates 426 iron vessels on the Seine Canal and Rhône route from Havre to Marseille. Its service covers 1,240 miles of rivers and 1,450 miles of canals.

(*b*) *Consolidation.*—There has in recent years been one important case of consolidation of vessel owners into a large corporation, or rather association, operating extensive fleets on inland waterways.

About ten years ago there were in France five important companies which together controlled the greater number of vessels in use on the internal waterways. Beside their fleets, numbers of boats were, and still are, owned by the men operating them, as individual bargemen, picking up charters wherever they could find one, and living on board with their families. The usual divergent policies and differing conditions brought the five companies into more or less frequent conflict which intensified as canal transportation developed and there came to be more and more through shipments of cargoes from one part of France to another. This lack of uniformity led to the association of the three principal companies for the facilitation of through traffic and the maintenance of rates on a level basis. Soon after the two remaining companies assumed reciprocal relations, and later actually combined, and after that degree of organization had proven successful a general community of effort was agreed to.

The five companies now operate under terms of agreement for rates and conditions. They have adopted a general tariff, and are able, of course, to exercise considerable influence on conditions of towing and handling. They control the small traffic of France, though under laws which are reasonably strict and in the public interest. They are subject at all time, of course, to the competition of the railways, but are able to refuse to carry freights at rates below those which they have established as the profitable basis.

But to a large extent the inland navigation of France still remains in the hands of the small barge or boat owner, whose limited capital is mainly invested in his craft. The last census (1907) shows that two-fifths of the vessels other than steamers belong to bargemen who own each only one boat, which they manage themselves. There were in service in 1907, 13,300 barges and canal boats provided with cabins and on which 18,600 men, 10,800 women, and 16,200 children were living. There were 2,750 vessels, mainly on the canals of northern and central France, which were provided with stables on board in which were carried 2,400 horses and 2,100 mules and donkeys, which were used for towing on such portions of the canals and rivers as a practical towpath is available.

(*c*) *Railroad ownership.*—No vessels are owned, operated, or controlled by the railroads. The coal trade and that of oil as well have considered the operation of their own carriers, but as yet have not done so, and transport through inland waterways under contract

with the members of the association referred to above. On the other hand, companies have been formed for the operation of boats under contract especially for the use of these trades. For instance, coal, lumber, and ore are carried on the Seine in especially constructed barges owned by La Compagnie la Seine and by l'Union Normande, while oil carriers are built and operated by Desmarais Frères and by Deutsch & Co.

(*d*) *Public authorities.*—No fleets of merchant vessels are owned or operated by public authorities in France.

(*e*) *Monopolies of towing.*—The important instance of a combination or monopoly controlling towing on canals and rivers is observed in the association of canal-boat owners referred to above in (*b*), these companies owning their own towing steamers and using them whenever possible. They thus secure uniform rates throughout France on the interior waterways.

On the navigable rivers and in the ports there are towing concerns operating fleets of boats, and sometimes these fleets are extensive enough to cover more than one port. There is no general monopoly of this business, but the companies in possession of the towing at each port and along each river are naturally in position to cut rates and exclude newcomers. Horse towing is done by companies in many cases, but there is no evidence of any effort to create a monopoly of the business. Here again the ever-present competition of the railway works to reduce the opportunity for combinations tending to create arbitrary rates and to remove the natural conditions which would render monopoly advantageous. Several instances are on record of newcomers attempting to enter the towing field on French rivers only to be driven out by the existing company with its established service and its ability to reduce rates temporarily below the living point.

There is in the district of Nantes a towing enterprise on the canal from Nantes to Brest which is subsidized by the Government and supervised by the administrations of ponts et chaussees. This service was established to make up for the lack of a practicable towpath along the River Erdre, which forms part of the route. The contract is sold at public auction for an amount within the limits of the subsidy, and specifications regulate the duties of the contractor and the rates for towing vessels.

There are a few exceptions to the general freedom of towing which exists on most French canals and waterways. Thus on the St. Quentin and St. Martin canals, where a great number of boats have to pass tunnels which form only a single channel, the Government has taken charge of the towing by means of steamers. The same is true on the canals from the Marne to the Rhine and from the Marne to the Aisne, where electric mules are in use, and on the Nivernois Canal, where gasoline tugs are employed.

The decree of June 19, 1875, monopolized, under government control, towing on the great northern route of which the St. Quentin Canal forms a part, and the traffic, consisting largely of coal, has increased since that date from two to five million tons per annum. Another case of the same kind was the grant of a monopoly of towing by the act of December 23, 1903, to the chamber of commerce at Douai, on the canal from Pas de Calais to Ghent.

## V. TERMINAL FACILITIES.

(*a*) *Docks and wharves.*—The most striking physical feature of the river and coal terminal facilities in France is their simplicity of design. The absence of show work and expensive office buildings and mechanisms is noteworthy. American visitors to France, as to other continental countries, often fail to appreciate the high degree of utility rendered by canal and other similar systems on which the most of the work is out of sight. Low cost of labor and abundance of good material has made it possible to construct all canal and river terminals in masonry. No timber is used for permanent work. White granite is the most frequent material, though broken common stone is sometimes used for facings, with cement.

Locks are of both metal and timber, the former predominating. At some river terminals gates of this character set up in the early sixties are still in successful and economical operation. Hydraulic power is commonly used for moving locks and drawbridges. Jetties are invariably of stone, cemented, and seaport work is frequently protected by heavy, loose granite cuttings strewn along the ocean side of the pier or breakwater. Tidal barriers and ice breakers are sometimes of timber. Wharves are of stone, with iron piles for moorings.

Warehouses are of brick, in the old style, and in the more modern design have steel frames and corrugated iron roofs and sheds for storage of goods not requiring especially dry conditions.

Generally speaking, the tendency in French terminal architecture is to place the vessel alongside the line of natural bank rather than at piers projecting therefrom.

(*b*) *Methods of handling freight.*—Modern methods are used practically throughout France for loading and unloading vessels on inland waterways, the degree naturally depending upon the importance of the locality. Longshoreman labor is of the usual type. Vessels are put alongside the terminal by tugs, or sometimes warped into a basin by the hand-and-cable method. Cargoes are removed by cranes in most instances, though sometimes, from canal boats carrying miscellaneous freights, by hand. The crane is the ordinary method. Oil is frequently pumped direct from the tank barge into the shore tank.

Cranes on French terminals are found in almost every variety. Some are fixed in the piers, some are on cars which move along the pier face under their own power, and others are built on floating hulls for use in basins and harbors. The usual power used for operating cranes is steam. Electric cranes are increasing. Coal is taken out in buckets, which are filled by hand shovels and hoisted from the barges or holds. It is loaded through shutes in the usual manner. Grain is taken out in buckets, shovelled by hand in the hold and swung to the car on the pier. Miscellaneous cargoes and crates are secured on wooden platforms in the hold, made fast to the crane gear with chains, and swung out onto pier or cars at will.

Electric cranes are being used for miscellaneous cargoes at some of the more up-to-date terminals, with much success. Their ordinary capacity is from 1 to 2 tons, but at Havre there is a hydro-electric crane capable of lifting 120 long tons at a load. There are large numbers of floating steam cranes handling from 5 to 20 tons. As the development of French terminals advances there is a tendency

to make use of all these various forms of power, electricity apparently being the more favored as time goes on.

A good example of river appliances is found at Rouen on the river Seine, which, by reason of its extensive importations of coal, is one of the most important docking points in Europe. As stated elsewhere in this report, local chambers of commerce, in consideration of their appropriations of money for the improvement of waterways, are allowed certain rights in the dock arrangements of terminals. Thus, at Rouen, by authority of the ministry of public works, the chamber was authorized in 1907 to establish 20 new cranes on the docks of that city. Eight of these cranes are hydraulic, 4 being of 1¼ tons and 4 of 2½ tons capacity. Twelve are electric, each with a minimum power of 3 tons. Besides these the chamber was authorized to put up a large hoisting engine, 21 electric capstans, and to carry out such improvements in docks and canalizations as would render all these works the more effective. This programme has been partially completed and will be brought to a close, it is expected, early in 1910.

The General Government makes liberal provision for seaport harbors and terminals, but does for canal and river terminals only what is absolutely necessary to enable them to handle their traffic. In this respect, however, cities like Paris, Rouen, Caen, and Bordeaux, although more or less remote from the open sea, are ranked as seaports and receive the liberal care of the Government in respect to wharves and facilities for handling freight.

(*c*) *Railroad tracks at terminals.*—Railroad tracks are invariably in France, located on terminals of inland waterways, permitting direct transfer between railroad and water lines. In most places there has been a patent and successful effort to bring the railway yards and the port and river docks into reasonable and logical proximity. An example of this condition could be drawn from almost any terminal point in France. When different lines of railway enter a single port there is always a "belt line" connection by which cars can be handled from one line to another without transshipment of freight. Bordeaux and Rouen are good examples of this condition, and particularly the latter. At Rouen the Orléans Railway and the French State Railway (West Line) both enter the town. Their lines have a direct connection on the south bank of the Seine, contiguous to the larger freight-handling section along the river docks. This is a case of "deliberate design," since the State Railway has its passenger station on the north bank of the Seine, but has built freight yards on the south bank convenient to the river docks and the other railway. Paris, which on account of the immense traffic on the river Seine is actually one of the foremost "ports" of the Continent, is the most striking example of a city with numbers of diverging railways connected by a belt line for the transfer of freight cars. The terminal facilities of Paris are elaborately equipped and deserve a special description. The Javel terminus on the left bank of the Seine below Paris is connected by a short branch with the Western Railway system and the Grenelle freight yard. There are two quay sidings, 221 and 225 meters in length; a private siding 208 meters long which belongs to the municipality, and various other sidings and switches aggregating something more than a mile. The equipment includes a 12-ton transfer table for handling stone and 2 steam cranes of 2 and 3 tons lifting capacity.

The Ivry terminal, outside the fortifications and on the left bank of the Seine above Paris, was constructed in 1899 by the State, the suburban city of Ivry supplying half the cost of the work. The quay sidings and the branch-line connections with the Orléans Railway were built by the state engineers with funds contributed by the Paris Chamber of Commerce and are leased to the Orléans Railroad Company. The tracks on the quay aggregate a mile in length, and the terminal has an area of 24 acres. The equipment includes a warehouse with a superficial area of 4,306 square feet, two traveling steam cranes of 1½ tons efficiency, and weighing facilities up to 25 tons. The charges for the use of crane are as follows:

| | |
|---|---|
| One day | $12.00 |
| Half day | 6.00 |
| One night | 14.00 |
| Half a night | 7.00 |
| One hour (daytime) | 1.40 |
| One hour (night) | 1.80 |

Weighing charges are 2 cents per ton and the fee for hauling and shifting freight cars on the quay sidings is 3 cents per ton. The Paris Chamber of Commerce operates the Ivry terminal under a fifty-year contract.

Perhaps the most important and up-to-date terminal inside the walls of Paris is the quay of Austerlitz, on the south bank of the Seine and likewise connected with the Orléans Railway system. It was leased under a decree of August 26, 1908, to M. Perier de Feral, under condition that he would organize a company and transfer thereto the rights conferred by his lease. The terminal includes extensive warehouses and quays and is used for the storing of bonded and other freight and transfers from rail to boat, or conversely from river to rail. The warehouses are separated by passageways opening into a longitudinal street. Below the street level railway tracks are laid which run into the buildings. Chutes and monorail travelers are arranged so as to permit the loading of freight by gravity. Lifts connect the three floors and the roof; the latter is covered with cement and can be used for storing and handling freight in case of overflow from below. The appliances include quick-acting power cranes of from 1 to 5 tons capacity, monorail transfer tables, which enable freight to be lifted directly from vessels and landed without handling in the warehouses or upon cars.

The quays at Bordeaux are fitted with lifting apparatus as follows: One large stationary crane lifting 1½ tons; 13 revolving cranes, of which 11 have a lifting power of 3,300 pounds, and 2 a power of 6,600 pounds; 20 hydraulic cranes of which 15 are of 3,300 pounds lifting power and 5 of 6,600 pounds; 1 hydraulic crane of 10 tons capacity, on a rolling carriage; 1 hydraulic oscillating crane, with lifting power of 80 tons.

(*d*) *Ownership of terminals.*—River and canal terminals are generally owned by public interests. There are some minor examples of railways owning or controlling facilities for handling fuel supply; but there are no important instances, and it is proper to consider the separation between the railway and the docking facilities as practically complete. This condition is very much simplified in France by the absence, comparatively speaking, of railway competition for the possession of water-front outlets. It is the rule in France that all docks are under government direction and control.

(*e*) *Dockage fees.*—No separate public list of dockage fees and other terminal charges can be supplied for France, where the system of charges is very complicated and varies from one port to another. There is also a necessary difference, and a wide one, between procedure at essentially inland ports, reached only by canal, and those on navigable rivers open to the sea so that they come under regulations drawn to include deep-sea traffic as well as that carried in canal boats and barges.

There is a very valuable review of French port charges, entitled "French port charges," published in Paris in 1899 and translated into English by Mr. J. Soulsby Rowell, Lloyd's agent in Havre and late British vice-consul at that port. This work will be found of exceptional value to the American student of the subject.

### VI. TOLLS AND FREIGHT RATES.

(*a*) *Tolls.*—No tolls are charged on French rivers and canals, the system having been abolished by the law of October 1, 1880. The tolls were abolished upon the insistent petition of the internal navigation interests of the country, which showed that the railroads enjoyed rate advantages which were maintained, not by traffic, but by the prevailing system of government taxes. The truth of the matter was that in 1878 the Government had removed from the railroads a merchandise tax of 5 per cent of the rate, thus giving the land lines a distinct preference.

The toll system, according to competent observers, never worked evenly in France. Difficulty was experienced even in the reign of Louis XVIII, after the day when the waterway revenues were given out from the throne as the rewards of favoritism. At that time tolls were applied only to the waterways upon which they were collected. The Crown altered the system to bring all the toll earnings into the royal treasury, and again, in 1825, another government revised the method in order to give the canals the benefit of what they collected in fees. There was always much friction between the central and local authorities, however, and it appears to be good history that the final abolition of tolls in 1880 effected a very general relief. However, their removal was dictated by considerations of traffic competition, as already stated. Two notable exceptions, however, to this rule, were created by acts of legislature which granted to the chambers of commerce at St. Dizier and Douai authority to borrow $1,000,000 and $6,000,000, respectively, to aid in constructing the Northern Canal and the canal connecting the Marne and the Saône, and to repay principal and interest of these sums by small tolls per ton-kilometer on coal, stone, ore, and agricultural products.

There do exist on French waterways, however, tables of special charges which amount in effect to tolls. Some of them are collected by the concessionaires of the few remaining canals not actually handled by the Government itself; others, as in the case of the canals of the city of Paris, are collected by the public authorities having jurisdiction of the waterway; while a third class is taken up by the Government. In a general way it can be said that these charges are on cargoes, either for passing through locks, or for loading and discharging freight.

On the Garonne Canal, for example, the charge for handling freight is 10 cents per long ton (50 centimes per 1,000 kilos).

On the lateral Marne Canal, where the Government has established cranes for handling freight, the charges are $3 for the first hour, and $2 for each following hour; $10 for a half day of five hours, and $18 for a day of ten hours, for the use of the mechanical apparatus. Besides that charge, there is a schedule of prices applicable to various articles of merchandise, to cover the cost of unloading or loading, of which the following is a copy:

| Class of freight. | Charge per ton. |
|---|---|
| Sand and gravel | $0.09 |
| Grindstones, millstones, etc. | .10 |
| Wines in casks | .12 |
| Coal | .13 |
| Bricks, tiles, and broken stone | .14 |
| Cut stone, wood in the bark, and cut wood | .20 |

These tolls are applicable to full cargoes or to partial cargoes of at least 50 tons, shipped under one bill of lading to a single port. For smaller lots of freight the tolls are fixed, under the law of 1901, "to the satisfaction of both parties, but not more than double the stated tariff."

On the St. Quentin Canal, the main line of which is about 80 miles long, the North Railway of France has established cranes at important junction points where its line meets the canal, and is permitted by law to charge 8 cents per ton for transshipping goods.

On many waterways throughout the country the Government has established unloading mechanisms, the tariff for the use of which varies with the locality, the amount of traffic, and the capacity of the machines. Chambers of commerce, as already noted elsewhere in this report, frequently build cranes and other landing apparatus, and have the right, under the Government, to collect tolls for their use. Rates vary greatly in these cases. A good example of low prices for such service is seen on the canalized river Escaut, in the north of France, from Cambrai to the Belgian frontier, a distance of about 50 miles. For the use of mechanical apparatus on this waterway boats pay from 30 cents to 80 cents an hour and from $1.25 to $3 per day.

On the river Loire a tax of 4 cents per ton is collected on goods transported from St. Nazaire to Nantes, which reverts to the chamber of commerce at Nantes as compensation for the expenses it sustains for the improvement and maintenance of the port of that city.

There are no cases, however, in which tolls are collected on vessels, strictly speaking.

(*b*) *Towing rates.*—The elements entering into the making of towing rates on canals and rivers are: The character of the waterway as to locks, channel, current, method of towage, direction of tow, tonnage of boats, and displacement of water according to weight of cargo carried. In some cases, and notably on the Seine River, the character of the merchandise affects the rate of towage.

Full information of towing rates on all French waterways is printed in the Guide Officiel de la Navigation Intérieure, published at Paris under the direction of the ministry of public works by E. Bernard & Co.

Another element naturally entering into the question of towing rates is that of competition between towing companies. On the

inland canals and some of the rivers above the head of maritime navigation there is no competition, since the Government either gives out the privilege by concession, fixing the rates of towage, or establishes facilities for the use of the boatmen who carry their own men or horses, and makes a small charge therefor. But on some of the larger canals and on the navigable rivers which carry a mixed maritime and inland traffic competition has a marked effect.

Thus, on the Seine, and through all the connecting series of waterways where the great combination of canal transportation interests operates most actively, towing is done by the boat operators, with their own horses, men, or steamers. Throughout France, even on canals where the towing concession has been granted to a private person by the Government, any barge company may tow its own boats with its own steamers, and as a matter of fact these companies have built such steamers for just such service. This has rendered them independent of the towing companies, such as the one which does the harbor and river work at Havre, for instance, and which charges 39 cents per ton for towing barges to Rouen, a distance of 55 miles.

On the river Loire the rates for towing are based both on the length of the vessel and the quantity of goods transported. Thus, from Nantes to Montjean, a distance of 37 miles, the rate is 3 francs, or 57 cents, per meter of the length of the barge plus 1 franc, or 19.3 cents, per ton of cargo carried. For example, a barge 26 meters long, carrying 100 tons of cargo, would pay for the barge 78 francs and for the cargo 100 francs; total, 178 francs, or $34.35, or 34.3 cents per ton.

(*c*) *Freight rates.*—Inland water lines have regular schedules of freight rates, and they are published in book form. There are no classifications of freight, each article paying its own rate. Ostensibly, rates are stable. The flat rate for ordinary quantities is reduced when shipping in large cargoes or in lots making several cargoes. Published rates usually state a special price for lots of cargo of 5 tons and over.

It would be difficult to answer the question as to varying rates and traffic exigencies without injustice to the French shippers and others from whom this information has been secured. The laws under which rates are fixed in France are strict in their terms, and rebating is punishable with considerable penalties. More or less latitude obtains in practice, however, in making up rates on interior waterways, particularly under the combination arrangements into which the more important transportation companies have entered for the control of the canal traffic of the country. The fact remains, however, that the tables of rates as issued contain no provision for abatements or rebates to meet the varying exigencies of traffic. Note should also be taken of the fact that in France, apart from the domestic traffic carried on canals and rivers, there is an immense trade in transit freights of this character. Of the $200,000,000 which represent the value of such freight transported across France every year, carried from continental manufacturing centers either to the seaboard or to the British Isles or in the opposite direction, a large quantity is borne on interior waters and affords an underlying and very stable volume of income which can only be affected seriously by general European business depression so great as to be of extremely rare occurrence. This condition, which can obtain only in a country where the internal waterway system is highly developed through a very long period of time, renders such

lines independent of local traffic exigencies in a degree equal to the measure of continuous income derived from these through shipments. It would not obtain at all in a country where canal construction was comparatively new and through connections undeveloped.

The following tables will show the average rates of freight during an ordinary year on waterways and canals between certain important centers of production and consumption for various classes of goods, in metric tons (2,204 pounds):

| Termini. | Distance, in miles. | Goods. | Freight rates— | |
|---|---|---|---|---|
| | | | Per ton. | Per ton-mile. |
| Denain, on the Escaut-Ris, near Paris | 219 | Coal | $0.875 | $0.0039 |
| Denain, on the Escaut-Montéreau | 265 | do | 1.05 | .0039 |
| Harnes, near Sens-Souppes on Loing | 302 | do | 1.26 | .0041 |
| Meurchin–Choisy-le-Roi (Paris) | 237 | do | 1.15 | .0048 |
| Mons (Belgium)–Paris | 233 | do | .99 | .0042 |
| Charleroi (Belgium)–Paris | 237 | do | 1.79 | .0075 |
| Palinges, on Canal-du-Centre–Paris | 258 | do | .875 | .0034 |
| Do | 258 | Bricks | .815 | .0031 |
| Beffes, on Loire Canal–Paris | 163 | Lime | .825 | .0050 |
| Châlons-sur-Seine–Joinville | 311 | Tiles | .97 | .0031 |
| Bretoux–Courbevoie (Paris) | 291 | do | 1.06 | .0036 |
| St. Quentin–Montargis | 242 | Phosphates | 1.06 | .0043 |
| Fourchambault on Loire–Paris | 170 | Steel | .875 | .0051 |
| Bretoux–Paris | 278 | Iron | .875 | .0031 |
| Palinges–Rouen | 409 | Starch | 1.94 | .0047 |
| Juvisy–Eleu-Levin | 246 | Barley | .92 | .0037 |
| Athis-on-Seine–Roubaix | 268 | Paving stones | .56 | .0021 |
| Havre–Paris | 231 | Coal | 1.35 | .0058 |
| | | Lumber | 1.54 | .0066 |
| | | Grain | 1.93 | .0083 |
| | | Flour | 1.93 | .0083 |
| | | Furniture | 4.24 | .0183 |

(*d*) *Conditions affecting water rates.*—(1) Rates are affected by distance of haul, the tariff decreasing materially in proportion to it. For example, while Paris is more than twice the distance from Havre that Rouen is, the rate on wine in barrels to Paris from Havre is $3.47 per quintal of 220.46 pounds, and from Rouen to Paris $2.32.

(2) Quantity of commodity offered affects the rate in certain cases only, and such cases are found specified throughout the schedule of rates. For instance, the rate on potatoes from Havre to Paris is $1.93 per ton for ordinary quantities, and for more than 5 tons only $1.54 (on the Seine River).

(3) Speed does not affect the rate; that is, the schedules take no account of it in any way. For loading and unloading, expedition would affect the terminal charges by increasing the cost of using the cranes and other facilities at debarking points.

(4) Character of commodity affects the rates throughout, there being, as already stated, a distinct rate for each article of freight entering into canal and river transportation. For example, the rate for cotton in bales from Havre to Paris is $2.50 per ton, while the rate for fertilizers for the same haul is $1.93 per ton or $1.35 in quantities of over 5 tons. Every other article in the entire category has its special rate alphabetically indicated in the schedule. The table given above under paragraph (*c*) of this section will clearly illustrate the manner in which rates for any given distance by river or canal are affected by the nature of the merchandise. The elements which enter most largely into this disparity of rate are the

value of the merchandise for a given bulk or weight, and the amount of care which it requires in transit, handling, and storage. Thus furniture, which forms one of the highest classes of freight, is valuable, bulky, and requires to be transported in covered boats and handled with care when loaded or discharged. As under commercial laws the boat owner is responsible for the loss of or damage to his freight—unless this should happen from "force majeur" or some calamity over which he can have no control—the questions of value and inflammability, or liability to deterioriation, or injury naturally enter into the problem of rates for transportation. Still another element which affects inland waterway rates is the question of return cargoes—whether or not a boat loaded for a certain point will be able to obtain a cargo for the return trip, and, if so, how long a delay at the point of discharge and reloading will likely be involved.

In the north of France owners of barges often treat with shippers through expéditeurs or forwarding firms, which charge a brokerage for their services in making contracts between shipper and boat owner. The incomplete organization of the freight market often causes loss of time, so that the waterways and ports are obstructed with empty vessels. Accordingly, the collieries have recently agreed to fix a date for loading, which must be completed within twelve days, otherwise they must pay a demurrage of $1.60 per day from the thirteenth to the fifteenth day, $2 per day thence to the twenty-fifth day, and $3 per day thereafter until the barge is loaded. Similarly, demurrage, at the rate of $1.60 per day is paid to the bargeman, if his boat, on arrival at its destination, is not unloaded within the time agreed upon.

(*e*) *No prorating arrangements* exist between railroads and water lines in France. Railway freight rates being fixed by governmental control, naturally set a limit to the advance of water rates wherever the two come into direct competition.

(*f*) *Competing railroad and water rates.*—Railway freight schedules are controlled, as will be explained under paragraph (*h*) of this section, by a permanent consultative committee of railways representing the various ministries and bureaus of the French Government, and this commission takes care that the freight rates of railways are not fixed so low as to fatally compete with the waterways. Railway rates are, however, more or less affected by waterway competition. For example, from Nantes to St. Nazaire, which cities are connected by rail and by a water route 37 miles long, the railway rate on coal is 30 cents per metric ton, whereas from Nantes to Cholet, the same distance, but where no waterway competition exists, the railway rate for coal is 55 cents per ton. There is no apparent reason for this difference except that in one case there is waterway competition while in the other there is not.

### A COMPREHENSIVE AND TYPICAL EXAMPLE.

There is in France no other trunk line waterway so vital and important to many interests as the river Seine, and there is no clearer illustration of the normal competition between rail and water rates than the freight schedules of the Northern Railway and the Seine between Havre and Paris, a distance of 142 miles by rail and 231 by river. In view of the importance of such a concrete illustration of all the elements which enter into the question of competing rail and water rates

the following special report, contributed by Consul James E. Dunning, of Havre, is herewith inserted as a supplementary response to the several interrogatories under Section VI. It describes the river Seine by sections from Rouen to Montereau, with rates for towing, etc., for each section, describes the nature of freight handled, and the comparative rates per ton and per ton-mile by rail and river from Havre to Paris.

THE RIVER SEINE—HOW THAT STREAM SERVES THE COMMERCE OF FRANCE AS A TRUNK-LINE WATERWAY.

The river Seine, which connects not only Paris but the richest portion of interior France with the port of Havre, is a striking example of a waterway in which the service of canal and river are directly combined. At Havre, and from that port to Rouen, it has the maritime aspect; from Rouen to Paris it is the river pure and simple; beyond Paris for nearly 120 miles it is the canal or canalized river to the head of its navigation, at Mery-sur-Seine. Its total navigable length is 345 miles (563 kilometers). The canal of the upper Seine carries its waters about 35 miles farther.

The Seine is divided into nine sections from Mery to the sea. The work of canalization does not cover the channel as a whole, nor has it been subject to anything like a connected history. It is impossible to estimate accurately the total cost of all the improvements which have been made since the eighteenth century upon it. It is known, however, that the two most vital canalizing operations along its course—viz, that of the upper Seine, between Montereau and Paris for a distance of 60 miles, and that from Paris to Rouen for a distance of 155 miles—have cost at least $16,500,000, or, practically, $76,750 per mile. The cost of the Montéreau section to date is stated at $5,000,000 and of the Paris-Rouen section $11,600,000. In this estimate the cost of the work on the maritime section from Rouen to Havre is not included. General improvements on the channel have probably cost $2,000,000, while the Tancarville Canal, connecting the port of Havre with the river, has cost about $4,000,000. A total of $6,000,000 would be a conservative estimate of the cost of this work below Rouen. Probably all the work on the channel of the Seine, taking only the separate undertakings and omitting any account of cost of maintenance, has involved an expenditure of more than $25,000,000.

The first of the nine sections into which the Seine is officially divided is 26 kilometers long, and extends from Mery to Marcilly. It is only nominally navigable, and the traffic of the region is carried on the upper Seine canal already mentioned, which parallels the river. The second section, 68 kilometers long, is from Marcilly to Montéreau and is entirely canalized. It carries barges of not more than 4.55 feet draft, or over 125 feet in length. It controls the water by means of 7 dams and 13 locks. It is crossed by 45 bridges (including all passable structures), which have an average height of 15 feet above water level. There is direct connection between the canal landings and the East Railway line. Towage is by horses.

The third and fourth sections extend from Montéreau to Paris, 98 kilometers. Barges of 6 feet draft, 125 feet length, and 15 feet beam can navigate these sections. Six hundred-ton barges and steam vessels of from 100 to 250 tons make up most of the traffic. There is

direct railway connection at various points on the line, as well as at Paris, the chamber of commerce of which municipality has erected extensive freight-handling works and terminals. The charge for the use of steam and electric cranes is 10 cents per ton, and for transshipment between canal side and railroad station 11 cents per ton. Charges for the use of storehouses on terminals are 10 cents per ton for one day, and 1 cent per ton for each subsequent day up to six days, and 7 cents per day per ton for additional time.

There is direct connection with the Paris Belt Line. Towing is by steamers. A telegraph line runs along the entire course and is open to public use at all stations. The fifth section of the Seine includes the portion within the municipal limits of Paris, with a length of 12 kilometers and a depth on the average of 10.6 feet. Towage is by tugs. All classes of barges navigate the section in the course of the vast traffic passing through it. There are 25 landings. There are no public handling machines, such work being done by private enterprise, which controls numbers of floating cranes and other apparatus, hired by the traffic at from $16 to $20 per day according to the season. Besides these, there are about 20 land cranes owned by private capital. There are direct landing connections between barges and railway cars. The section has a telegraph line.

The sixth section is 21 kilometers long, extending from the confines of Paris to the mouth of the St. Denis Canal at La Briche, and is one of the most important divisions in spite of its comparatively brief length. Towage is done by a private company which owns 18 small boats used in the service, while there are some independent tugs operated by concerns engaged in the traffic itself. The company's steamers accept tows for the Paris-Rouen or Rouen-Paris traffic, rates varying between summer and winter from $28 to $45 for barges of 280 to 350 tons downstream, and $45 to $110 upstream; to $40 to $65 for barges of 450 to 600 tons downstream, and $80 to $160 going up.

The section is equipped with special docks for handling freight, for entrance to which barges pay 6 cents per ton lockage with a minimum charge of $5 per boat. Unloading costs 19 cents per ton. Eight cents per ton is charged for transshipping goods to the North Railway line. There are cranes operated by private persons, the charge for the use of which vary from 10 cents to 35 cents per ton according to the nature of the freight handled. This apparatus may be rented outright at $1.35 per hour, the first hour being counted double. Coal is handled on this section at 14 cents per ton.

The seventh section of the Seine extends from La Briche to the junction of the main stream with the river Oise, 42 kilometers, draft 10.66 feet.

The eighth section, 171 kilometers, extends from the Oise to Rouen, draft 10.66 feet, with 7 locks. All the way from Paris to Rouen there is a towing path, but it is little used on account of the activity of the steam towing companies and of the boats owned by the barge concerns themselves. The steam vessels run from 130 to 280 tons, and the barges from 200 to 600 tons, taking them as a whole; but of later years there have appeared classes of steam barges carrying 750 tons on the maritime Seine or from 450 to 500 tons on the canalized portions, and another group of 1,000-ton steamers which make a regular service via the Seine between Paris and London. There is direct connection with the railways in the Seine valley and at Rouen, and a public telegraph line covering the section, with stations at every lock.

The condition of the eighth section is reported to be such as to demand extensive improvements, which will cost a large sum.

The ninth section is the maritime Seine, from Rouen to Havre, 125 kilometers long, and offering a channel 20 feet in depth. Two pilot stations are maintained on this section, which is frequented not only by the usual canal traffic but by that carried in steamers of 5,000 tons burden From the port of Havre connection is had with the river through the Tancarville Canal, 15 miles long, which does away with the necessity for leaving the shelter of the Havre breakwaters and navigating the shifting channels of the Seine's sea mouth. There are several points of railway connections along the section, which has its own telegraph line. Towing is done by three specially organized companies, who conduct their operations on all the other sections of the river when circumstances demand it.

The cost of towing on the Seine differs with the sections. On the upper sections over the short distances, tariffs run from 5 mills to 1 cent per ton light, and from 1 to 2 cents per ton loaded.

On the 60-mile Montéreau section already referred to, towing of boats going upstream costs $0.00054 per ton per kilometer, or $0.00088 per ton-mile, for light barges; and for loaded barges $0.0037 per ton-mile. Downstream traffic pays one quarter of these rates. Fertilizers pay a reduced tariff of 37.5 per cent both ways. When the price of wheat at Paris rises above 25 francs per hectoliter, or $1.70 per bushel, the towage on such cargoes is reduced by a similar amount (37.5 per cent) per ton for all foodstuffs excepting wines, on which the tariff stands.

Below Paris, on the other hand, on that division of the river known as the lower Seine, as distinct from the maritime section below Rouen, there are entirely different rates of towage for different portions of the stream. On certain short sections local companies have the towing business and operate under tables of local rates regulated by the Government. The most convenient example of towing conditions on the lower Seine is afforded by the rates existing under government regulation on the eighth section, length 171 kilometers (105 miles), extending from the mouth of the Oise River to Rouen.

The company operates under laws passed in 1860 and 1892. For barges with at least half a load the rate is not more than $0.0019 per ton-kilometer, or $0.003 per ton-mile, going upstream, and going downstream $0.001 per ton-mile. For barges with less than half a a load the rates are in proportion. Empty barges going in either direction pay $0.06½ per mile when less than 150 tons; $0.11 per mile for craft from 150 to 250 tons; and $0.16 per mile for vessels above 250 tons.

When the price of wheat at Paris rises above $1.70 per bushel, the upstream rates are reduced by $0.0015 per mile on all foodstuffs excepting wine, on which the tariff stands. For fertilizers, guano excepted, the towing rate is $0.0015 going up and one-half that rate going down. The towing companies have the right to collect the fees before taking lines aboard. They are empowered to count fractions of tons as whole tons and fractions of a mile as the whole of that distance. The rule concerning lower rates for foodstuffs during time of special need is a common one on French waterways, and is often applied, under the decrees fixing the towing rates, to cereals and vegetables.

On the maritime section of the Seine much of the navigation is done in steamers under their own power or by barges towed by tugs operated by their owners. The towing companies on the part of the river charge ordinarily 39 cents per ton for carrying barges from Havre to Rouen, 77 miles.

### THE TANCARVILLE CANAL AT HAVRE.

The principal canal work on the maritime Seine is the Tancarville Canal, which connects the port of Havre with the river Seine at Tancarville, 15 miles away. Through this waterway not only barges but steamers are able to pass into the safe waters of the river without attempting the sometimes difficult conditions of current and tide prevailing in the roads at its mouth. The cost of the canal originally was about $4,650,000 and it was opened to navigation in 1887.

The channel of the canal was built through alluvial soil, of which 5,000,000 cubic meters was excavated in the course of construction. A branch connects the main channel of the canal with Harfleur. There is 19½ feet of water between Havre and Harfleur and 11½ feet from Harfleur to Tancarville. The width from Havre to Harfleur is 62 feet and from Harfleur to Tancarville 81½ feet. The normal water level is 3¾ feet below the mean land level between the termini.

The terminal works at Havre consist of a basin 163 by 750 feet, of a lock 587 by 98 feet, and of a main fluvial basin 1,900 feet long and 197 feet wide. The canal is crossed by nine swing bridges operated by water power. There is a telegraph line along the bank. All terminal and lock work is of granite. The Havre Chamber of Commerce contributed $1,000,000 to the cost of the canal and the Department of Seine-Inférieur $200,000, the balance being appropriated by the General Government.

At each terminal the canal is protected by special locks and gates against the variations in level of the river. Towing is done by steam tugs. Traffic in 1908 was 1,620 boats going upstream, with 481,000 tons of goods, and 1,661 boats coming downstream, with 117,000 tons. Besides there were 60 scows going up and 49 returning. These are about average figures, though there has been a slight decrease in the traffic since 1898. The effect of opening the canal was to reduce rail freight rates from 20 to 60 cents a ton. It took much of the rail trade in wine, lumber, petroleum, coal, and cotton.

### NATURE OF THE TRAFFIC ON THE SEINE.

About half the coal consumed annually in Paris reaches that city by canal, and a large quantity of the supply passes up the Seine. Rouen is one of the most important ports of entry for coal shipped into France from England and Wales, about 60 per cent of all the traffic passing up the maritime section of the Seine being made up of coal cargoes. In the year 1908 there entered the river port of Rouen a total vessel tonnage of 1,638,443 (including French tonnage), all of this passing the maritime Seine. The lack of return cargoes to balance the coal importation, however, operates against the use of this river as a perfect illustration of a navigable waterway with rail competition, as in 1908 the total cargoes shipped out of Rouen down the maritime Seine to all parts of the world was only 341,904 tons.

The British consulate at Rouen, in its annual report for 1908, stated that owing to the improvements in the maritime Seine, coal vessels from Wales can arrive at Rouen, discharge cargo, return to Wales, load and reach the docks at Rouen again in the period of eight days. The capacity of this waterway can be estimated when it is stated that vessels in the coal trade often make three trips per month between the mines and the river docks.

Coal is thus the great item in the traffic of the maritime Seine, and the larger part of it is transshipped for Paris, being taken out of the steamers and put into light-draft barges for carriage through the upper sections of the river. In this way, in 1908, Paris received enough coal to have filled 200,000 ordinary French railway cars. To accommodate this increasing disposition to use the waterway rather than the railway for coal traffic, special yards have been built at Rouen for handling the cargoes, and a new series of 1,100-ton barges has been put in service, drawing 9 feet maximum and thus safely reaching Paris on the usual 10-foot scale of water.

The total movement of the port of Havre is about 8,000,000 a year (tonnage of vessels). How much of this goes up the maritime Seine is impossible to state with accuracy, though the proportion is small because much of the Seine traffic now enters the river channel without coming through the Havre port at all. It is a matter of record, however, that from the port there entered the Seine, en route to Rouen, via the Tancarville Canal (15 miles long and effecting a way of circumventing the passage of the difficult mouth of the river) 3,281 vessels carrying 598,000 tons of cargo. These are figures for both directions and for the year 1908.

The fact is that the Seine, between Havre and Rouen particularly, and along most of its course in general, is a specially advantageous coal route, but is inferior to the railways in the handling of miscellaneous freights. Still, its influence upon the railway service and upon the rates which the railways charge is highly important and has had an important effect in the development of this part of France. It is to be remembered, however, that in France the railway rates (and those on the canals and rivers) are fixed by the Government, so that there is no opportunity in this case to study the results of natural competition pure and simple.

Following is a table showing the comparative cost of transportation for various articles between Havre and Paris, both on the rail line and via the Seine:

*Freight rates, Havre-Paris, rail and water.*

| Article. | By rail. | | By water. | |
|---|---|---|---|---|
| | Rate. | Per ton-mile. | Rate. | Per ton-mile. |
| | | *Cents.* | | *Cents.* |
| Bacon | $4.41 | 3.10 | $2.895 | 1.21 |
| Beer, in casks | 4.41 | 3.10 | 1.93 | .83 |
| Butter | 7.35 | 5.11 | 2.895 | 1.21 |
| Cement | 1.64 | 1.15 | 1.64 | .71 |
| Cheese | 2.895 | 2.03 | 2.509 | 1.08 |
| Coal | 1.35 | .95 | 1.35 | .58 |
| Dry goods | 4.23 | 2.98 | 4.825 | 2.09 |
| Fertilizers, in bags | 1.93 | 1.35 | 1.93 | .83 |
| Flour | 1.93 | 1.35 | 1.93 | .83 |
| Furniture, in cases or crates | 8.86 | 6.24 | 4.246 | 1.83 |
| Glassware, common | 2.895 | 2.03 | 2.316 | 1.002 |
| Grain | 1.93 | 1.35 | 1.93 | .83 |

*Freight rates, Havre-Paris, rail and water*—Continued.

| Article. | By rail. | | By water. | |
|---|---|---|---|---|
| | Rate. | Per ton-mile. | Rate. | Per ton-mile. |
| | | *Cents.* | | *Cents.* |
| Iron, bar | $2.123 | 1.49 | $1.64 | .71 |
| Lumber | 1.64 | 1.15 | 1.544 | .66 |
| Machinery, farm, in parts | 2.316 | 1.63 | 2.123 | .91 |
| Machinery, other, cased | 2.895 | 2.03 | 2.316 | 1.002 |
| Molasses | 1.93 | 1.35 | 1.93 | .83 |
| Potatoes | 2.123 | 1.49 | 2.316 | 1.002 |
| Shoes | 5.98 | 4.21 | 4.246 | 1.83 |
| Spades and shovels | 2.895 | 2.03 | 2.316 | 1.002 |
| Sugar | 1.93 | 1.35 | 2.509 | 1.08 |
| Window glass | 1.93 | 1.35 | 2.123 | .91 |
| Wine, in casks | 4.05 | 2.84 | 3.474 | 1.50 |

NOTE.—Distance by rail, 142 miles; by water, 231 miles. Upstream rates are given only. Weight is metric ton.

Slightly lower rates than these are given for carload lots by rail, and by water for 4 tons and over. Downstream rates differ only slightly from upstream and for a few articles only. All this traffic would pass via the Tancarville Canal.

### THE ROUBAIX CANAL.

Another typical example, showing the importance of a small canal in an industrial district, is that known as the Roubaix Canal, about 15 miles in length, which connects the river Escault in Belgium with the French river Deûle, that passes through the important coal mining districts in the Departments of the Nord and Pas de Calais and flows into the English Channel at Dunkerque. The canal permits the passage of vessels of 285 tons burthen, drawing 7 feet of water. It was opened for traffic in 1877, and the traffic has increased from 164,068 tons in that year to 642,458 tons in 1908. The number of barges loaded at Roubaix on this canal increased from 2,816 in 1901 to 3,512 in 1908.

The distance from Roubaix by canal and rivers Oise and Seine to Paris is 245 miles, with 69 locks, and the trip of a coal barge for this distance varies from fifteen to twenty days. Boats are generally of wood, except the iron steam barges of the Pavat Company of Paris, which have a practical monopoly of the rapid service. Towing is done by horses or men, aided when the wind is favorable by a sail.

The following tabular statement, furnished by Consul Joseph E. Haven, of Roubaix, shows the total classified traffic by the canal at that port for each year from 1898 to 1908, inclusive:

| Year. | Combustibles. | Building material. | Industrial products. | Agricultural products. | Machinery, wood, etc. |
|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1898 | 334,103 | 111,836 | 30,794 | 96,553 | 30,966 |
| 1899 | 293,932 | 115,657 | 31,929 | 142,832 | 28,185 |
| 1900 | 295,447 | 96,956 | 39,626 | 77,072 | 31,810 |
| 1901 | 351,660 | 89,863 | 30,614 | 95,593 | 31,593 |
| 1902 | 375,550 | 73,279 | 26,514 | 91,206 | 29,107 |
| 1903 | 397,228 | 113,935 | 32,614 | 116,594 | 38,057 |
| 1904 | 353,421 | 123,125 | 26,563 | 153,879 | 57,701 |
| 1905 | 353,145 | 87,862 | 36,060 | 167,572 | 37,576 |
| 1906 | 362,924 | 108,664 | 17,720 | 192,203 | 52,811 |
| 1907 | 367,564 | 99,695 | 40,772 | 156,521 | 33,527 |
| 1908 | 321,802 | 129,150 | 28,591 | 116,728 | 46,187 |

(*g*) *Mutual attitude of rail and water lines.*—There are no agreements between railways and water lines for a division of traffic and the competition between them is active and constant. Railroads are restrained by government supervision from making excessively low rates to compete with water routes. Canals and navigable rivers being government property, the state, through its authority over railway traffic, naturally provides that the water routes are not subjected to railway competition which might prove ruinous. When, for any reason a railway company has been permitted to make a reduced freight rate, it can not advance that rate to its former figure without permission of the government supervisory board, which, is under such circumstances, difficult to obtain.

(*h*) *Legislation and insurance.*—There is no general law or decree regulating the relations and competition between railways and inland water systems of transportation. The rates on railways are controlled by a permanent commission known as the "Comité consultatif des chemins de fer," or consultative committee of railways, made up of two classes of members, viz, membres de juré and members nominated and appointed by decree. The membres de juré include former ministers of public works, who are members of the Senate or Chamber of Deputies; the chairman of the committees on railways and customs in the Senate and Chamber; the chairman of the committee of public works, railways, communications and customs in the Chamber of Deputies; and the directors of railways, navigation, mines, personnel and accounts, in the department of public works.

The members appointed by decree include 12 Senators, 12 Deputies, 5 councellors of state in the department of public works, 2 members of the court of appeals, besides representatives of the ministries of finance, labor, agriculture, foreign affairs, interior, war, colonies, posts and telegraphs, bridges and roads, two members of the consultative chamber of commerce and manufactures, and two representatives of the workmen and employees.

This powerful and somewhat unwieldy commission maintains strict control over the tariffs of railway rates for freight and passengers and the interpretation of laws relating thereto, controls all agreements between railway companies, propositions for the issue of bonds and for the construction and operation of new lines, etc. Although not specifically required by law to do so, the consultative commission does not, as a rule, approve any railway freight tariff which does not leave a fair margin of 20 per cent between the railway rates and those of competing water lines between the same points.

*Insurance.*—As has already been stated in a previous paragraph, the law of commerce renders the carrier responsible for the merchandise committed to him for transportation, except in cases where the loss has been caused by some calamity of nature over which he could have no control. No agreement is permitted which invalidates this obligation. The boat owner must therefore include in his rate the cost of insurance for his vessel, for the cargo, and for the liability which would be entailed in case of collision and damage to another boat, or to the locks or walls of the canal. In exceptional cases the shipper may also insure his merchandise in transit. But as a rule the cost of insurance is borne by the barge owner, or the transportation company which owns the steamer or other craft on which the freight is carried. Insurance on hulls is usually effected by an annual

policy, and the premium varies from 1½ to 3, or even 4 per cent of the value of the boat. The premium for insurance on an old boat is higher than that for a new one, and for wooden hulls the rate is higher than for those of iron or steel. The premium for insurance on goods in transit depends on their value and susceptibility to damage by fire, water, and abrasion. As an example, the insurance on freight between Rheims and Rouen by the Seine and Marne rivers and the Marne Canal varies from 4 to 6 cents per metric ton. The premium for a year's policy on an ordinary coal barge, including vessel, cargo, and liability to damages to canal, locks, or other boats, ranges from 150 to 170 francs, that is $30 to $34. As a principle, it can be stated that the cost of insurance is so small as to have little appreciable effect on water freight rates.

## VII. WATER-BORNE TRAFFIC.

(*a*) *General character of traffic.*—The commodities carried by water vary somewhat in different sections of France, but include principally, coal, wood, stone, fertilizers, phosphates, ores, grains, flour, soap, wine, oil, crockery, glassware, iron, steel, machinery, cement, lumber, sugar, potatoes, in fact most kinds of general merchandise of low or medium value, which is not subject to deterioration by delay in delivery. The details of proportion and character of traffic moved in different directions on each canal and waterway in France are given in the volume Statistiques de la Navigation Intérieure, for 1907, published by the French Government. The subject is too diffuse and complicated to be condensed within the limits of a consular report. A general idea of the nature and amount of freight moved on the French waterways during an average year will be derived from the following table:

*Tons shipped and received.*

| Group. | Merchandise. | River traffic. | Canal traffic. | Total water borne. | Percentage. |
|---|---|---|---|---|---|
| 1 | Coal, coke, briquettes | 2,693,535 | 7,359,550 | 10,053,085 | 29.5 |
| 2 | Stone, gravel, lime, etc | 7,586,768 | 4,779,640 | 12,336,408 | 36.3 |
| 3 | Fertilizers | 777,645 | 652,113 | 1,429,758 | 4.2 |
| 4 | Wood and lumber | 827,297 | 950,726 | 1,778,023 | 5.2 |
| 5 | Metals, machinery, etc | 379,149 | 488,742 | 867,891 | 2.6 |
| 6 | Ores, scrap, sand, etc | 378,061 | 1,099,701 | 1,497,762 | 4.4 |
| 7 | Industrial products | 508,611 | 613,006 | 1,121,617 | 3.3 |
| 8 | Agricultural products | 1,899,353 | 2,585,531 | 4,484,884 | 13.2 |
| 9 | Unclassified | 159,985 | 139,275 | 299,260 | .9 |
| 10 | Raft wood, all kinds | 109,384 | 22,395 | 131,779 | .4 |
| | Total tonnage | 15,339,788 | 18,690,679 | 34,030,467 | 100.0 |

The vast importance of water-borne traffic for the city of Paris will be shown by the following condensed exhibit of the commerce of this port during the ten years from 1898 to 1907, inclusive:

| Year. | Number loaded vessels. | Total weight cargoes. | Shipments. | Arrivals. | Transit. | Local traffic. |
|---|---|---|---|---|---|---|
| | | *Metric tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1898 | 46,457 | 9,164,825 | 1,814,196 | 5,280,788 | 1,418,806 | 651,035 |
| 1899 | 52,048 | 10,481,483 | 2,662,221 | 5,848,370 | 1,321,855 | 649,037 |
| 1900 | 46,174 | 9,301,491 | 1,484,152 | 5,699,861 | 1,437,324 | 680,154 |
| 1901 | 44,721 | 8,900,684 | 1,704,510 | 5,197,808 | 1,432,410 | 565,956 |
| 1902 | 45,653 | 9,238,056 | 1,960,894 | 5,354,405 | 1,370,850 | 551,907 |
| 1903 | 48,111 | 9,857,146 | 2,329,999 | 5,694,952 | 1,345,968 | 486,227 |
| 1904 | 49,235 | 10,130,830 | 2,421,110 | 5,689,027 | 1,465,743 | 454,950 |
| 1905 | 50,192 | 10,202,828 | 2,507,747 | 5,763,864 | 1,504,506 | 426,711 |
| 1906 | 50,904 | 10,525,136 | 2,490,238 | 6,273,610 | 1,390,280 | 371,008 |
| 1907 | 50,109 | 10,845,558 | 2,342,359 | 6,310,861 | 1,793,809 | 398,529 |

If this record is extended backward so as to include the year 1884, it will be found that during the period of twenty-four years ending with 1907 the total weight of cargoes has increased 103.21 per cent; the shipments, 312.19 per cent; the freight arriving, 62.88 per cent; freight in transit, 387 per cent; and local traffic 24.32 per cent per annum.

(*b*) *Official publications.*—There are two comprehensive official publications: (1) Statistique de la Navigation Intérieure (Statistics of Internal Navigation) giving complete tabulated statistics of the movement of vessels and freight by river and canal for 1907—the latest published—and (2) Statistique des Chemins de Fer Francais (Statistics of the French Railways), giving in elaborate detail the statistics of French railway traffic for the same year. In both these publications the figures for 1907 are compared with those of preceding years. To these may be added a volume entitled Recensement de la Batellerie, Navigation Intérieure (Census of Vessels, Interior Navigation), which shows the classifications and number of vessels of all kinds used on French canals and waterways during the years 1902 and 1907, grouped according to the port, waterway, or district to which they respectively belong. The comparison thus presented shows at a glance the increase or decrease of boats in each class from the year 1902 to 1907. The units employed in all these publications are naturally metric, viz.: Kilometers, equal to about five-eights of a mile, and metric tons of 1,000 kilograms, or 2,204 pounds avoirdupois.

(*c*) *Relation of local to through traffic.*—This is a detail concerning which the official statistics afford relatively very little information, and it is therefore difficult to give a comprehensive and exact reply.

The table which is given under topic (*a*) Section VII, of this report, shows the total tonnage of water-borne traffic handled at the port of Paris during each year from 1898 to 1907, inclusive, the latter being the latest year for which official statistics are available. From that exhibit it appears that of 98,648,037 tons of freight received, shipped, or passed in transit through this port during the ten years, only 5,235,574 tons, or 5.3 per cent of the whole amount, are classified as "local traffic." In the volume Statistics of Internal Navigation there are given, from page 122 to 247, very complete statistics of the movement of tonnage at each port on the various canals and rivers for the year 1907. These tables give the number of vessels loaded

and discharged, whether going up or down stream, the total weights of freight, classified into the ten groups according to nature and material, as shown above under topic (*a*) in this section. These tables divide the total tonnage into two groups in respect to origin, viz, (1) traffic originating on the river or canal in question or coming to it from another waterway or district. These totals are again subdivided into "Interior traffic," "Shipments," "Arrivals," and "In transit." Assuming that interior traffic means substantially "local commerce," it becomes possible from a study of the tables to obtain an approximate idea of the relation of local to through traffic in each case. From a comparison of the number of typical cases given in these tables, it would appear that the "Interior traffic" of ports on French canals and rivers varies from 3 to 6 per cent of the whole amount handled.

The total movement on all canals and navigable rivers in France for the year 1907 is classified as follows:

| | Tons. |
|---|---|
| Shipments | 1,182,399,691 |
| Arrivals | 850,938,102 |
| In transit | 3,145,235,710 |
| Interior traffic (local) | 192,178,038 |
| Total | 5,370,751,541 |

Judged from these aggregates, therefore, the "Interior" or local traffic of the French waterways in 1907 was only 3.5 per cent of the total tonnage recorded.

(*d*) *Conditions of labor.*—The various classes of petty officials and employees along the canals and navigable rivers of France are, as a rule, meagerly paid and are obliged in many cases to devote their leisure hours to some other form of employment. Lock and weir keepers frequently keep a small store or restaurant; others devote themselves to gardening, truck farming, or some other form of productive labor in order to eke out a living for themselves and their families.

The following schedule of salaries paid to the several classes of employees and petty officials on the canals and waterways is formulated for this report by the department of public works. "Navigation keepers," as designated in this list, are charged with the duties of watching boats to see that they enter and pass locks promptly, keep to their proper positions in the channel, and do not unduly obstruct navigation.

The schedule of salaries is as follows:

| | |
|---|---|
| Chief machinists, per year | $340 to $560.00 |
| Navigation keepers (with the option of outside employment when not occupied with official duties), per year: | |
| First class | 206.00 |
| Second class | 186.00 |
| Third class | 166.00 |
| Fourth class | 156.00 |
| Fifth class | 146.00 |
| Lock keepers (with the option of other employment), first class | 126.80 |
| Lock and weir keepers (with the option of other employment), second class | 116.80 |
| Bridge and weir keepers (with the option of other employment), per year: | |
| Third class | 106.80 |
| Fourth class | 96.80 |
| Fifth class | 86.80 |

Traveling expenses and extra service during night hours are, when authorized, paid for in addition to the above salaries.

Salaries and wages on board vessels in the river and canal service are as follows (per month):

| | |
|---|---|
| Captain of a tug or chain towboat | $38. 60–$58. 00 |
| Mate (second in command), towboat | 23. 16– 35. 00 |
| Boy, for general work | 6. 00– 15. 50 |
| Pilot of barge or lighter | 27. 00– 38. 60 |
| Assistant pilot, lighter | 20. 00– 29. 00 |

The pilot and assistant pilot steer the boat, and must therefore know the channel and the rules of navigation. They usually live on board and receive, in addition to their salaries, lodging, candles, and $2 each for each loading or unloading of the vessel.

The bargemaster or captain is usually the owner of his boat and derives his compensation from the earnings of the business, which vary with the abundance of freight, the current, rates, stage of water, and other contingencies, but as a rule his profits are small in proportion to the capital involved. Individual cases are cited in which a bargeman owning two boats, representing together an investment of $6,000, and giving his entire time and energy to the business of navigating them, has come out at the end of the year with a net profit not exceeding 1,000 francs, or $200. All accounts agree that the competition of the railways, especially in miscellaneous freights, is very serious and that barges on canals and rivers are less profitable than they were a few years ago.

The standard of living for the employees on barges and canal boats is generally low, the men, with the exception of the master and pilot, being often illiterate. They are paid from $20 to $25 per month, live on board, and usually provide their own food, lodging and candles being provided free. Dockers and longshoremen in large ports like Paris, Lyon, and Bordeaux are comparatively well paid, earning from 5 to 10 francs ($0.97 to $1.93) per day in good times, but their employment is more or less irregular and they are liable to be out of work part of the time when traffic is dull.

As has been stated in an earlier paragraph of this report, it is generally recognized by intelligent economists in France that railways can not supplant the canals and rivers for the transportation of coarse, heavy freights, and that the railroads must find a welcome relief through inland navigation in the handling of superabundant bulk traffic. A pertinent example of this is found in the experience of the Northern and Eastern railway companies in the transportation of coal.

Both these railways have a large coal tonnage from the mining districts of the North and Charleroi, in Belgium, to Paris, and both have to compete with canal transportation. In order to dominate this competition, the railroad companies some years ago made and secured from the government commission the approval of rates so low that increased tonnage no longer produced an increase of net earnings. The effect of this policy is shown by the following comparison:

On the Northern Railroad the coal traffic, as expressed in ton-kilometers during two specified years, was as follows:

| | Ton-kilometers. |
|---|---|
| 1900 | 1, 811, 054, 078 |
| 1905 | 1, 973, 769, 843 |
| Increase | 162, 715, 765 |

During the same years the receipts from coal traffic were:

| | Francs. |
|---|---|
| 1900 | 55,257,794 |
| 1905 | 53,670,752 |
| Decrease | 1,587,042 |

The experience of the Eastern Railway was quite similar, viz:

COAL.

| | Ton-kilometers. |
|---|---|
| 1900 | 539,778,139 |
| 1905 | 790,199,453 |
| Increase (45 per cent) | 250,421,214 |

The receipts from the coal traffic during the same two years were:

| | Francs. |
|---|---|
| 1900 | 18,212,386 |
| 1905 | 19,364,029 |
| Increase (5 per cent) | 1,141,643 |

The teaching of these figures is obvious. Internal waterways can under normal conditions in France carry coarse bulk freights, like coal, ore, stone, lumber, etc., at rates with which railways can not profitably compete. Not only this, but on several trunk lines the traffic has grown to such proportions that no important increase could be economically and promptly handled without a costly expansion of trackage, equipment, and terminal facilities. The teaching of experience, here as elsewhere, is that the normal function of internal water transportation is to relieve the railways of superabundant raw materials and other low-grade freights, while the latter should carry the more precious and lucrative products of manufacture, agricultural produce, and other merchandise which from its nature requires prompt transmission and delivery.

FRANK H. MASON,
*Consul-General.*

PARIS, FRANCE, *November 30, 1909.*

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# INLAND WATERWAYS AND CANALS AND RAILWAY RATES OF THE UNITED KINGDOM

REPORT BY

JOHN L. GRIFFITH

AMERICAN CONSUL-GENERAL AT LONDON

WASHINGTON
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# NATIONAL WATERWAYS COMMISSION.

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This report was made in answer to questions prepared by the National Waterways Commission and the Department of Commerce and Labor and submitted to American consuls through the Department of State.

## Part I.

### QUESTIONS SUBMITTED BY THE DEPARTMENT OF COMMERCE AND LABOR THROUGH THE DEPARTMENT OF STATE RELATIVE TO RIVERS AND CANALS IN FOREIGN COUNTRIES.

### I.—*Public supervision.*

(*a*) State what public authority, national, state, or local, exercises supervision in the different instances over navigable streams and canals.

(*b*) What are the powers and duties of such officials in regard to the following:

(1) Capitalization of navigation corporations.
Regulation of freight rates.
Reports of operation.
Maintenance and improvement of channels, docks, and terminal facilities.

(2) Collection of statistics of water-borne traffic, and by what agencies such statistics are compiled and published.

### II.—*Waterway improvements.*

(*a*) Is there any established policy as to water powers developed by works constructed for improving navigation? Give illustrations.

(*b*) To what general extent have river improvements and the construction of canals been carried on by the central government, by local governments, and by private enterprise? Give typical and important illustrations of each. Describe any system of cooperation and contribution between the central government and local government in such works.

### III.—*Floating equipment.*

(*a*) What is the general character of vessels used on rivers and canals?

(1) The relative use of self-propelled vessels and towed vessels.

(2) Motive power for barges and canal boats.

(3) Size and draft of vessels.

(4) The use of iron, steel, and wood in vessel construction.

(5) The cost of various types of boats.

(6) The use of special types of boats for particular cargoes and on different classes of waterways.

(7) The size of fleets of barges.

(8) Is the type of boats adapted to low-water stages, or are they constructed with a view to utilization in high water?

In each case specific information is desired showing the situation in typical instances rather than general statements of a summary character.

### IV.—*Ownership of vessels and business organization.*

(*a*) Do canal companies or other waterway improvement companies own and operate vessels? Give examples.

(*b*) Are there important cases of consolidation of vessel owners into large corporations operating extensive fleets on inland waterways?

(*c*) To what extent are vessels owned and operated by railroads, or by producing and distributing concerns, such as coal, oil, lumber, ore, etc., fleets? Give examples.

(*d*) Are there any fleets of merchant vessels owned and operated by public authorities? Give examples.

(*e*) Are there important instances of combinations or monopolies controlling towing on canals and rivers? Give examples.

V.—*Terminal facilities.*

(*a*) What are the important or striking physical features of river and canal terminals, such as docks, wharves, piers, and floating wharf boats? Give illustrations and send photographs with this answer.

(*b*) Describe the most advanced methods of loading and unloading vessels on inland waterways, including the use of mechanical appliances.

(*c*) Are railroad tracks located on terminals of inland waterways, permitting direct transfer between railroad and water lines? Do such railroad tracks form a belt railroad, connecting all the railroads at a given port? Give examples.

(*d*) Are river and canal terminals owned by public or private interests? Are they owned at all by private railways? If so, give the important instances.

VI.—*Tolls and freight rates.*

(*a*) Are tolls charged on canals and rivers? If so, what elements are considered in framing them and what service do they cover? Are there separate tolls for boats and cargo? Give typical illustrations.

(*b*) What elements enter into the making of towing rates on canals and rivers? Give illustrations of towing charges and send copies of any tariffs or towing rates.

(*c*) Do inland water lines have regular schedules of freight rates and classifications of freight? Are the rates stable or do they vary frequently with traffic exigencies? Give illustrations.

(*d*) How are inland waterway rates affected by—

(1) Distance of haul?
(2) Quantity of commodity offered?
(3) Speed?
(4) Character of commodity?

Give illustrations on important waterways.

(*e*) Do prorating arrangements exist between water lines and railroads, and to what extent? Give illustrations and send copies of joint rail and water tariffs.

(*f*) How do inland water rates affect railroad freight rates? Are railroad freight rates to water competitive points higher than to interior nonwater points of similar distances? Give illustrations.

Compare inland water rates with paralleling railway rates for short and for long distances, giving specific illustrations which shall show whether waterways have greater competitive power in the one case than in the other.

(*g*) What is the general attitude of rail and water lines toward each other? Is there active competition or are there agreements for the division of traffic? Give examples.

(*h*) Is there any legislation regulating the relations between rail and inland waterway systems of transportation? Is there any governmental restriction on the lowering of rail rates in competition with water rates? Give examples.

(*i*) Is it customary for shippers of goods by inland waterways to insure them, or is the risk assumed by the carrier? To what extent does this affect the freight rate? Give examples.

VII.—*Water-borne traffic.*

(*a*) What is the general character of traffic on inland waterways: The principal commodities moved, the proportion and character of traffic moved in different directions, relative importance of package and bulk freight, etc. (This should be answered specifically for different waterways.)

(*b*) Send official publications giving, for the last ten years, available statistics of vessel movement and traffic carried on inland waterways; also railroad traffic, tonnage, and ton-mileage.

(*c*) Taking important inland water routes, does local traffic or other traffic predominate, and in what general proportion?

(*d*) Give a concise statement of typical conditions of labor which is employed in navigation and in terminal handling, particularly with reference to wages paid.

NOTE.—The above questions were revised by the members of the National Waterways Commission.

## Part II.

### QUESTIONS RELATING TO FOREIGN RAILWAY RATES SUBMITTED BY THE NATIONAL WATERWAYS COMMISSION THROUGH THE DEPARTMENT OF STATE.

I. Give ten examples of rates on coal on different railway lines for different distances, with the following details:

(*a*) Give termini for each shipment.

(*b*) Give distances of each shipment, including in the list of ten rates at least three rates for the maximum distance that coal is shipped.

(*c*) Give separately the terminal and transportation charge. (If this is not possible, make note of the fact that the two are combined.)

(*d*) State what service is covered by the terminal charge.

(*e*) State the class of rate into which the coal traffic falls; that is, whether the rate is a special or commodity rate or a normal class rate, and if the latter, what class.

(*f*) Give all other facts concerning method of shipment which affect the rate, such, for example, as minimum carload weight or minimum train load, open or closed cars, fast or slow freight, and the like.

(*g*) If any of these rates have been given to encourage the development of any industry, state the facts.

II. Answer the above seven questions (*a* to *g*), quoting in each case ten examples of rates on different railway lines for different distances for the following commodities:

1. Iron ore.
2. Stone.
3. Lumber.
4. Fertilizers.
5. Grain.

III. Give ten illustrations of special rates granted to export business on different railways for different distances, and answer in each case the questions propounded above for the coal traffic (*a* to *g*) so far as they are applicable to the export business. Make a statistical tabulation comparing these export rates with local rates between the same termini.

IV. Give ten illustrations of rates charged by different railways for different distances on the highest grade of classified freight, that which, in many countries, corresponds to the express business of the United States, and answer in each case the questions propounded for the coal traffic (*a* to *g*).

V. Give ten illustrations of rates charged by different railways for different distances on typical products included in the various categories of the regular freight classification, showing both carload and less than carload rates, and answer in each case the questions propounded for the coal traffic (*a* to *g*).

VI. Are the freight rates based absolutely on distance, or is the rate per ton-mile less for longer distances? Show, in the case of different commodities, at what distances the fall in the rate per ton-mile takes place.

# INLAND WATERWAYS AND CANALS AND RAILWAY RATES OF THE UNITED KINGDOM.

## PART I.—INLAND WATERWAYS AND CANALS OF THE UNITED KINGDOM.

### I. Public Supervision.

(*a*) What public authority—national, state, or local—exercises supervision in the different instances over navigable streams and canals?

There is no general public authority, as far as the navigable streams and canals of England and Wales are concerned, which owns or controls them.

So far as Ireland is concerned, the development of inland navigation in that country has been very different from its development in England and Wales, the initiative in the last-named countries coming from private individuals, while in Ireland, as Mr. George A. Stevenson, one of the three commissioners of public works in that country, stated in his evidence before the royal commission appointed to report upon the canals and inland navigation of the United Kingdom, that "from the beginning the state in Ireland has taken the greatest interest in canals, and has given the greatest encouragement, both in the way of administration and in the way of grants. As early as 1703 inland navigation formed the subject of consideration in the Irish Parliament, the journals from that year containing references to proceedings and grants. The first act on the subject was passed in 1715, and was entitled 'An act to encourage the draining and improving of the bogs and unprofitable low grounds, and for easing and dispatching the inland carriage and conveyance of goods from one part to another within this Kingdom.'"

From time to time additional acts have been passed, and at the present time, while the rates of navigation are fixed in the railway and canal traffic act of 1888, the canal systems of Ireland have been carried out either by private companies under special acts of Parliament or by the board of public works in Ireland.

In Scotland the Caledonian Canal is owned by the British Government and is under the control of the Caledonian canal commission, of which the speaker of the House of Commons is ex officio chairman, with the chancellor of the exchequer, the first lord of the admiralty, the lord advocate for Scotland, the member of Parliament for the county of Argyle, and the Duke of Argyle, ex officio commissioners. Other commissioners may be appointed by the King from time to time from among the proprietors along the route of the canal.

The Crinan Canal is also the property of the Government and its affairs are administered by the Caledonian canal commission.

The Forth and Clyde Canal is owned and operated by the Caledonian Railway, and is not subject to any public authority—national,

state, or local. The River Clyde is managed and operated by a body known as the Clyde navigation trustees. This is a parliamentary trust incorporated by Parliament, but self-contained, so far as its executive powers are concerned. Leaving Ireland and Scotland aside, however, it may be said that the canals and inland navigation of the United Kingdom are under private control.

A comprehensive statement of the conditions concerning the canals of England and Wales are set forth in the testimony of the assistant secretary of the railway department of the British Board of Trade, who testified before the royal commission that "there are no such general provisions laid down by statute as to the construction of canals as there are in regard to railways, or as to the inspection thereof by the British Board of Trade prior to opening, as in the case of a passenger railway; and, indeed, previous to the passing of the railway and canal traffic act of 1888, the board of trade, although, no doubt, exercising some indefinite authority over canal companies, had no real control." Powers were given to the British Board of Trade in private canal acts—sometimes large powers—but they were not as a rule exercised. The railway and canal traffic act of 1888 made important changes in this regard. It substituted the present railway and canal commission for the railway commissioners. Revised schedules of maximum tolls, rates, and charges had to be submitted and settled by the British Board of Trade. Under this provision schedules of maximum tolls, rates, and charges were framed for 149 canals, and subsequently confirmed by Parliament in fifteen acts passed in 1893–94. The British Board of Trade is now empowered to call for returns from canal companies showing the capacity of the canal for traffic and its capital, revenue, expenditure, etc., and is also authorized to make inspections of canals the works of which are said to be dangerous or a hindrance to traffic. It may also prohibit, under heavy penalties, the application of railway companies' funds for the acquisition of an interest in a canal without expressed statutory authority. It is given the power to deal with unnecessary or derelict canals and may direct the abandonment of such canals by the existing proprietors, who may by order be released from liability to maintain the same, and the board may further, in the case of a derelict canal, make a provisional order transferring the canal to some body constituted to manage it, or to a local authority, but such provisional orders require confirmation by Parliament. Under the powers vested in the British Board of Trade inspections have been made of canals in England and Wales, and warrants of abandonment have been issued in the case of two unimportant navigations on the ground that they were unnecessary, and in the case of one derelict canal—the Thames and Severn.

The port of London is governed by an act of Parliament passed in December, 1908. It is provided in the act that the port authority shall be a body corporate by the name of "the Port of London Authority," and shall consist of 18 elected members, 17 of whom shall be elected by payers of dues, wharfingers, and owners of river craft, and 1 solely by the wharfingers. In addition there shall be 10 appointed members, 1 to be appointed by the Admiralty, 2 by the corporation of London (one of whom must be a member of the same and one not), 1 by the Trinity House, and 2 by the British Board of

Trade, 4 by the London County Council (two of whom must be members of the same and two not).

The variety of ownership of the canals and inland navigations of England and Wales is shown by the fact that a portion of the River Avon is owned by the docks committee of the corporation of the city of Bristol, and another portion by the trustees of an estate; the Birmingham Canal Navigations, comprising a large system of canals with many branches, and having a total mileage of 159 miles, are controlled by a company of proprietors known as the Birmingham Canal Navigations; the River Dee is controlled by what is known as the Dee Conservancy Board; and the Thames, outside of the jurisdiction of the London port authority, is under the management of the Thames conservancy board; the Glamorganshire and Aberdare canals are owned by the Marquis of Bute; the Grand Junction Canal, by a company of private proprietors; the River Hull, which is a free navigation for a portion of the way in the city of Hull itself, is under the jurisdiction of the Hull corporation; the River Humber is controlled by a body known as the River Humber conservancy commissioners; the Leeds and Liverpool Canal is owned by a private company; the Manchester Ship Canal is managed by a board of directors appointed by shareholders, and by the Manchester corporation; the River Mersey in one part is under the jurisdiction of the Upper Mersey navigation commissioners, and in another part under the jurisdiction of the Mersey docks and harbor board; the Oxford Canal, the Rochdale Canal, the Warwick and Birmingham canals, and most of the remaining canals are wholly controlled by private companies. The River Weaver is managed by a board of trustees elected by the proprietors, and a great many of the canals are either owned by railway companies or else they have a decisive voice in their management.

It will thus be seen that the managements of the waterways in England and Wales are under the control of a great variety of authorities, but in almost every instance they are private and not public bodies.

(*b*) What are the powers and duties of such officials in regard to the following:
1. Capitalization of navigation corporations.
Regulation of freight rates.
Reports of operation.
Maintenance and improvement of channels, docks, and terminal facilities.

Powers are conferred on the different corporations and companies by special acts of Parliament obtained by such bodies, and these vary in every instance.

The capitalization of navigation companies is fixed by the companies themselves and not by act of Parliament, or by any public authority, except that the act of Parliament which creates a canal company states the capital such company is authorized to raise, and it can not exceed the total amount stated in the act unless it makes a further application to Parliament and is granted authority to increase its capital.

The canal companies are not, ordinarily, carriers, the carrying being done by individual users of the canal, or by what are known as carrying companies, and the freight rates which they fix are not under official supervision. The maximum tolls which may be charged are, however, established by the railway and canal traffic

act of 1888, and by subsequent confirmatory acts which define the maximum rates that can be charged by railways and also the highest tolls that can be collected by canal companies.

While a canal company can charge any rates within the maximum rates fixed by Parliament, they can only do so subject to the following limits:

First. They must not give any undue preference to one trader over another.

Second. In respect to through rates, namely, rates covering transport over more than one canal or railway, in case of a dispute between traders and the railway or canal companies, the matter can be referred by either of the interested parties to the railway and canal commissioners.

It will be seen from the above that in the case of a controversy the trader, or the railway or canal company, must first appeal to the British Board of Trade. The practice has been for the British Board of Trade, on notification of such an appeal, to invite the different parties to the contention to send representatives to a conference, over which an official of the British Board of Trade presides, and in it he endeavors to effect an amicable adjustment. If he does not succeed, the question is then referred to the railway and canal commissioners for their decision.

Third. Every rate in force from each wharf on a canal must be entered in a book kept at the wharf, such book being open to public inspection.

In addition to the publication of all rates as above set forth, any trader who so desires can require the canal company to state how the rate is made up, how much is charged for conveyance, and what is assessed, if anything, for terminal and dock charges.

Fourth. If a canal company proposes to increase any rate it must give at least fourteen days' public notice of the fact.

Fifth. Where a canal is independently controlled, it can, provided no undue preference is given to one trader over another, charge up to the maximum rate, but where a railway company exercises control over a canal, the railway and canal commissioners have power to order a reduction in such canal rates, and thus restore the competition between the canal and the railway.

The British Board of Trade is the public supervisory body with respect to canals and inland navigation in the United Kingdom. Reports as to capital, revenue, receipts, expenditure, and traffic must be made yearly by all such companies to the British Board of Trade. Maintenance and improvement of channels, docks, and transit facilities are carried out or provided by boards of commissioners or companies from time to time controlling the waterways, and this is done either out of revenue derived from tolls, or by the raising of additional capital through bond issues or assessments upon the shareholders, and in some instances contributions are made by the local authorities.

Under the law each canal company is bound, "according to its powers, to afford all reasonable facilities for the receiving, forwarding, and delivering of traffic." If this is not done any trader or board of traders, or harbor authority, or town or county council, or sanitary authority may complain to the railway and canal commission and require that this provision of the law be complied with. The board

of trade, as already stated, possesses the power to inspect any canal when they have information that its condition is such as to be "dangerous to the public, or to cause serious inconvenience or hindrance to traffic." Special regulations apply to canals owned or managed by railway companies. They must at all times keep and maintain such canals and all the works "thoroughly repaired and dredged and in good working condition, and shall preserve the supplies of water to the same so that the whole of such canal, or part which they control, may at all times be kept open and navigable for the use of all persons desirous to use or navigate the same without any unnecessary hindrance, interruption, or delay."

The whole question, therefore, of the construction, development, and improvement of canals in England and Wales is left to private enterprise, and the only powers invested in the board are to require the maintenance of a canal when once it has been opened. Notwithstanding these powers many canals throughout the United Kingdom have been allowed to fall into decay, and while nominally open to traffic, are little used.

(*b*) 2. Collection of statisitcs of water-borne traffic, and by what agencies such statistics are compiled and published.

The statistics of traffic are kept by each company, with a yearly return to the British Board of Trade. These statistics are compiled and published periodically by the board. The publication is made at intervals of ten years, the first appearing in 1888, the second in 1898, and the report for 1908, it is expected, will be published shortly.

The statistics of coastwise traffic are compiled through the custom-house. Every vessel, on arrival at or leaving a port, has to deposit at the custom-house particulars of the cargo brought in or taken out. These statistics are only made public in the case of a few important industries.

In South Wales the information is published in respect to coal only, as to which a monthly table is issued showing the ports of destination of all coal sent coastwise. The British Board of Trade will, however, on payment, furnish to any person particulars as to the coastwise movements of other classes of merchandise.

## II. Waterway Improvements.

(*a*) Is there any established policy as to water powers developed by works constructed for improving navigation?

Generally speaking there is no such established policy in the United Kingdom. Each company prosecutes its own policy in respect to construction, improvement, maintenance and management.

In Scotland there is an established policy in the case of the River Clyde; the port authority is empowered to widen, deepen and straighten the channel way of the river, to maintain the river, to build and maintain docks, and to provide cranes and other equipment on the quays for the discharge and loading of vessels.

There is also at present a project for the development of the Caledonian Canal so that it may be enlarged to a depth of 30 feet, with 16 locks 600 feet long and 80 feet wide. Up to this time, however, except in a few matters of detail, it is claimed by an official of a Scotland canal that although the waterway which he represents

has been in use one hundred and eight years, and half of that time under government control, nothing has been done to enlarge it or to bring it up to date. "The idea," this official says, "that cheap waterway transit is a question of national importance does not seem to have occurred to any one until, perhaps, it is too late."

(*b*) To what general extent have river improvements and the construction of canals been carried on by the central governments, by local governments, and by private enterprises, etc.?

The various local authorities whose areas embrace the course of the navigable portion of such rivers as the Thames, Severn, Tyne, Mersey, etc., unite to form the river boards, with the object of improving and developing their respective rivers. Parliament has been asked, and has agreed, to confer on such boards the powers necessary to carry out these objects. These powers would include the right to buy land, to control navigation, to carry out works on the banks (including the erection of warehouses) and in the streams, to collect tolls from vessels using the river, to levy dues on merchandise shipped thereon, to raise capital on the security of such tolls and dues, and on the additional security of the local taxes collected from the population within the area of the various local authorities constituting the river board.

As a rule provision is also made in the acts of Parliament for traders, land owners, and other large interests, to elect representatives on the river board to act jointly with the representatives of the local authorities.

In the United Kingdom the construction and management of canals have been carried on by private enterprise under powers granted by special acts of Parliament, as before stated, with the following exceptions: The Caledonian and Crinan canals, which are national property; the Manchester Canal, which was completed by grants of money from the corporation, who have in consequence a controlling voice in its management, electing 11 directors out of 21; the Thames and Severn canals, which were taken over by the Gloucester County council under a warrant of abandonment in 1901, but are now closed; and some of the canals in Ireland.

There has not been, save in the isolated instances before referred to, any cooperation in the United Kingdom between the Central Government, local governments, and private owners. The attitude of the General Government and of local authorities has for a long time been apathetic, so far as waterway navigation in the United Kingdom is concerned.

There is no regular system in this country. The River Thames, for example, from its head to the sea, was from 1866 to 1909 under the administration of the Thames conservancy board. By the port of London act of 1908 the Thames above the limits of the tidal river has been separated for administrative purposes from the tidal river, which is now under the port authority, but the rest of the river has been put under the control of a new body of conservators, 28 in number, and they are appointed in different ways—some by public authorities, county authorities, town councils, and district councils, who have an interest in the river.

The River Severn from Gloucester to Stourport is managed by commissioners appointed by an act of Parliament in 1842.

Jurisdiction over the River Humber, which was in the hands of various authorities before 1907, has, after an inquiry was held, been invested in a single board of conservators.

The rivers and canals in the east of England are controlled by an extraordinary number of authorities, many of whom were originally appointed to supervise the drainage system, which is very important in that part of the country. To give an example, the River Nene is under the control of four different authorities. The first and second districts are under the jurisdiction of the Nene Valley drainage commissioners, but the second district has a different officer from the first. The third is controlled by another body of commissioners. The remainder of the river is divided between the jurisdiction of the Wisbech corporation and the Nene outfall commissioners.

The navigation of the River Ouse for a portion of the way is private property; then it becomes an open navigation having no controlling authority. At another point it is maintained by level drainage and navigation commissioners. At still another point it is controlled by the Bedford level corporation; further on by certain other drainage and navigation commissioners, and then again it becomes open navigation, and finally for a certain distance it comes under the jurisdiction of a body of sluice commissioners.

## III. Floating Equipment.

(*a*) What is the general character of vessels used on rivers and canals?

The character of vessels employed on rivers and canals in the United Kingdom vary greatly and there is no fixed standard. The types of vessels which are employed are determined partly by the nature of the waterways and its communications and partly by the special requirements of the traffic carried.

In Scotland the largest ocean-going liners navigate the Clyde as well as the smaller motor fishing boats. The types of craft used on the canals are many of them seagoing, but are necessarily of smaller width and draft. Among these types may be mentioned fishing steamers, sailing fishing boats, paddle passenger steamers, steam and sailing yachts, screw tugboats, paddle tugboats, dredges and barges.

In the case of the Crinan Canal most of the traffic is carried on by small screw steamers, in addition to the other small types which have been mentioned, while on the Forth and Clyde Canal large numbers of barges are used as well as small seagoing steamers.

The principal types of vessels used in inland navigation in England and Wales are detailed as follows in Bradshaw's work on Canals and Navigable Rivers of England and Wales:

### (1) nonsailing vessels.

"Narrow" boats, or "monkey" boats, are by far the most numerous type of vessel engaged in inland navigation. They are from 70 to 72 feet long by from 6 feet 9 inches to 7 feet 2 inches beam, and draw from 8 to 11 inches of water when empty, loading afterwards about 1 inch to 1 ton.[a]

The ordinary type of long-distance traveling narrow boat carries from 25 to 30 tons and is built with rounded bilges. The narrow

[a] The "ton" referred to is the English ton of 2,240 pounds.

boats in use on the Severn and in a few other localities for short-distance traffic are built with square bilges and carry up to 40 tons. This latter type of boat requires more power to haul, as it offers more resistance to the water, and also has the disadvantage of not being able to "carry a top," as the boatmen say—that is, they become top heavy in loading sooner than a boat with rounded bilges.

A modification of the narrow boat is found in Yorkshire, where there is a type of short boat about 58 feet long by 7 feet beam, made for the purpose of passing the short locks of the Huddersfield Broad Canal and Calder and Hebble Navigation and the narrow locks of the Huddersfield Narrow Canal.

Another small type of narrow boat is found on the Shropshire Union Canals, being made to pass the small locks between Wappenshall Junction and Trench; these boats measure 70 feet long by 6 feet 2 inches wide, and draw when empty about 12½ inches, and when loaded with 17½ tons, about 2 feet 8½ inches.

When an ordinary full-sized narrow boat is fitted up as a steamer, the reduction in cargo-carrying capacity amounts to about 10 tons.

Wide boats are boats of a size intermediate between the narrow boat and the barge; they are from 70 to 72 feet long by from 10 to 11 feet beam, and draw when empty about 11 or 12 inches, loading afterwards about three-fourths of an inch per ton to a maximum of about 50 tons. This type of boat is found chiefly on the Grand Junction Canal. The term "boat" in Yorkshire is also applied to a type of vessel built on the lines of a Yorkshire keel, but without masts and sails, and which as a rule do not navigate tidal waters.

Barges comprise a large number of vessels of widely varying dimensions, the largest of which, sailing barges of course excluded, are probably the Thames barges such as navigate the Surrey Canal, which admits of dimensions of 105 feet in length, 17 feet 9 inches beam, and 4 feet 9 inches draft.

Barges measuring 90 feet long by 16 feet beam, and drawing from 5 feet to 5 feet 6 inches, can navigate the River Lee to Enfield Lock, some of them carrying as much as 90 tons. The Regents Canal can pass barges 79 feet long by 14 feet 6 inches beam, with a draft of 4 feet 6 inches.

In all the above measurements of length the rudder is included.

A barge such as would pass Cowley Lock on the Grand Junction Canal, measuring 72 feet long without rudder and 14 feet 3 inches beam, would draw about 16 inches when empty, and carry 70 tons on a draft of 51 inches, loading, therefore, about 2 tons to 1 inch.

Leeds and Liverpool Canal short boats, which are the maximum size which can pass between Leeds and the bottom of the twenty-first lock at Wigan, measure about 62 feet long by 14 feet 3 inches beam, and draw when empty about 1 foot 2 inches, and when loaded with the maximum load of 45 tons about 3 feet 9 inches.

When these boats are constructed for use as steamers they are built so as to measure about 1 foot shorter and 3 inches less in width than the above dimensions, the reduction in cargo-carrying capacity amounting to nearly 15 tons.

Thames lighters, or, as they are termed by the watermen and lightermen, "punts," are swim-ended vessels—that is, they have flat, sloping ends; their dimensions average about the same as those of the barges, but they do not travel far away from the river. Their

advantage is that they are less damageable than barges, most of them having no helm; those fitted with helms are termed "rudder punts."

Bridgewater Canal lighters are of the same size as the Mersey flats, but are open vessels, and do not travel on the Mersey estuary. Their maximum load is about 50 tons.

Mersey flats are from 68 to 70 feet in length by from 14 feet 3 inches to 14 feet 9 inches in beam. Their draft when empty is about 1 foot 10 inches, and they load afterwards about 2 tons to 1 inch to a maximum load in open water of about 80 tons.

Weaver flats are usually about 90 feet in length by 21 feet beam, and draw up to 10 feet 6 inches of water with a load of about 250 tons, as when not exceeding these dimensions four can lock together through the locks on that river. Some of these flats are fitted up as steamers and others are plain flats for towing by steamers; there are also the No. 1 flats (sailing flats), which are now greatly reduced in number, owing to the increase of the steam traffic on the river.

Aire and Calder Navigation compartment boats, or "Tom Puddings," are oblong iron boxes towed on the Aire and Calder Navigation by steam tugs in trains, the length of the train varying from any number of the compartments up to a maximum of 32. Attached to the fore end of the first boat in the train is a short wedge-shaped boat called the "dummy bows," for the purpose of cleaving the water, and which carries no cargo. The old system of working these boats was by pushing them in front of the tug and steering them by two wire ropes which were passed along the train, one on each side. The ends of the ropes were connected to gear on the deck of the tug, by which either of them could be heaved in while the other one was slacked out; the use of these wire ropes has, however, been discontinued, the boats being now towed in the ordinary manner. The measurement of these compartment boats is about 20 feet in length by 16 feet beam and 7 feet to 7 feet 6 inches deep; they carry 35 tons on a draft of 6 feet.

Chelmer and Blackwater Navigation barges measure about 58 feet 6 inches long by 16 feet beam. Their maximum load is about 27 tons with a draft of 2 feet 2 inches. There are only one or two of these barges fitted with cabins, as the length of the navigation is only 13 miles.

Glamorganshire Canal, Aberdare Canal, Brecon and Abergavenny Canal, and Monmouthshire Canal boats measure about 60 feet long and about 8 feet 6 inches beam, drawing when empty about 13 inches, and loading afterwards about 1 inch to 1 ton. Their usual load is about 20 tons. The majority of these boats are without cabins.

Neath Canal and Tennant Canal boats measure about 60 feet long by 9 feet beam, and draw when empty about 9 inches, loading afterwards about 1 inch to 1 ton. Their average load is 20 tons and the maximum 24 tons. None of these boats have cabins; all of them are double ended, the rudder being transferred from one end to the other as required.

Swansea Canal boats measure about 65 feet long by 7 feet 6 inches beam, and draw when empty about 12 inches to 13 inches, loading afterwards about 1 inch to 1 ton up to 20 tons. None of these boats

have cabins; all of them are double ended, the rudder being transferred from one end to the other as required.

Fen lighters are usually about 42 feet long by from 9 to 10 feet beam at bottom to from 10 to 11 feet beam at deck, and draw when empty about 12 inches. They load a little more than 1 inch to 1 ton, drawing about 3 feet 6 inches when loaded with 25 tons. Owing to the beam at bottom being less than that at deck the immersion is, of course, greater per ton for the first portion of the cargo loaded than for the last.

Fen lighters are only met with on the waterways of the Bedford level and tributaries; they invariably navigate in gangs of about five lighters, the sternpost of one lighter being tightly coupled to the stem of the next by a "seizing chain." All the lighters in a gang except the first are fitted with poles projecting over the bows like bowsprits; the second lighter is fitted with a longer pole than any of the others, called a "steering pole," by means of which a man, or men, standing on the first lighter steer the whole gang unaided. Two ropes called "fest ropes," one from each end of the lighter, and passed around the fore end of the steering pole, are used to steady the pole as required when steering. The third and remaining lighters in a gang are fitted with shorter poles, called "jambing poles," whose fore ends are attached to either side of the lighter in front by ropes called "quarter bits." Not all fen lighters have cabins, but it is usual for one lighter in each gang to be provided with a cabin, and such lighter is termed a "house lighter."

River Stour (Suffolk) lighters measure about 47 feet long by 10 feet 9 inches beam, and draw when empty about 12 inches and when loaded with 13 tons about 2 feet 5 inches. They closely resemble the Fen lighters, and always work in gangs of two, the stern post of the fore lighter being coupled to the stem of the after lighter by a "seizing chain" and the gang being steered from the fore lighter by a "steering pole" fixed to the after lighter.

The locks on the river Stour can take in the two lighters at one time, and as each lighter can carry about 13 tons the capacity of the gang is about 26 tons. The after lighter contains the cabin and is termed a "house lighter," as in the case of the Fen lighters.

Upper Trent boats measure about 74 feet long by 14 feet 2 inches beam, and draw when empty about 20 inches forward and 14 inches aft, or an average draft of about 18 inches. When loaded with 32 tons, the average draft is 30 inches, and with 75 tons, 53 inches.

These boats, as will be noticed from the above dimensions, carry a good load on a small draft, as the upper portion of the river Trent has often but little depth of water. They would be quite unsuitable for carrying on the lower Trent traffic, as this necessitates navigating the Humber in order to reach Hull. Upper and lower Trent traffic is often transshipped at Newark, but upper Trent boats in no case ever go below Keadby.

Tyne wherries are the type of vessel in general use for conducting the local traffic on that river. They vary in size from 30 to 100 tons, and are usually towed by steam tugs.

Tub boats are in use on the Shrewsbury Canal of the Shropshire Union Railways and Canal Company, and on the Duke of Sutherland's canal, for carrying coal from Lilleshall pits up to and including Shrewsbury. Much of this traffic, however, which used to come by

tub boats down the Trench incline, is now sent by tramway to the end of the Humber Arm of the Newport branch, where it can be oaded directly into narrow boats.

Similar tub boats are also still at work on the Shropshire (Coalport) Canal, carrying coal and iron stone from the head of the canal to Blissers Hill blast furnaces. The above boats measure about 19 feet 9 inches long by 6 feet 2 inches beam by 3 feet deep, drawing when empty about 3 inches, and loading afterwards about 4 inches to 1 ton to a maximum load of 5 tons. They are towed by horses in trains of as many as 20 boats together, and are steered by a man walking along the towing path, who keeps the foremost boat in the middle of the canal by pushing against it with a long shaft.

On the portion of the Bude Canal in Cornwell, which is still open for traffic between Bude and Hele Bridge, some of the tub boats which used to carry the traffic on the old tub-boat canal above Marhamchurch incline continue in use. These boats measure about 20 feet long by 5 feet 6 inches beam and 2 feet 9 inches deep, and draw about 4 inches when empty, loading afterwards about 4 inches to 1 ton up to a maximum load of 4 tons. They work in trains, but, unlike the Shropshire tub boats, the first boat in each train has a pointed bow instead of being flat ended. Steering is effected by a man standing in the bow of the second boat and prying with a handspike between the after end of the first boat and the fore end of the second boat, so as to force them out of the straight line as required.

### (2) SAILING VESSELS.

Medway sailing barges are built in sizes ranging from 65 to 150 tons, the usual large-size barge being about 120 tons. A 65-ton barge, such as would pass the locks in the London district of the Grand Junction Canal, would gauge the same as an ordinary barge with the addition of about 4 tons extra in respect of the mast, spars, sails, and gear.

Yorkshire keels measure about 57 feet 6 inches to 58 feet long, and from about 14 feet 2 inches to 14 feet 8 inches beam, and draw when empty from about 2 feet to 2 feet 6 inches, loading afterwards between 5½ and 6 inches per 10 tons up to a maximum draft of about 6 feet to 6 feet 9 inches with a load of about 80 to 100 tons at this draft.

Yorkshire keels like Fen lighters are built of less beam at the bottom than at the deck, and similarly the immersion is greater per ton for the first portion of cargo loaded than for the last.

Severn trows measure about 70 feet long by 17 feet beam and draw when empty from between 3 to 4 feet; they carry about 120 tons on a draft of from 8 feet 6 inches to 9 feet 6 inches.

Lower Trent boats measure from 70 to 80 feet long by from 14 feet to 14 feet 6 inches beam and draw when empty about 15 to 17 inches, loading afterwards from about 8 to 9 inches per 20 tons up to a maximum of from 80 to 100 tons.

No. 1 flats are vessels trading up the river Weaver from Liverpool and district. Their numbers are now much reduced owing to the growth of steam traffic on the river. For average dimensions, etc., see Weaver flats (*a*) nonsailing vessels.

Norfolk wherries vary in size from 12 to 83 tons. A 12-ton wherry measures about 35 feet long by 9 feet beam, and would draw when

empty about 2 feet and when loaded with 12 tons about 3 feet 6 inches. A 20-ton wherry is a size of which many are in use; they measure about 54 to 56 feet long by 13 to 14 feet beam, and draw when empty about 2 feet and when loaded with 20 tons about 4 feet.

The largest wherry ever built is supposed to be the *Wonder* of Norwich, which measures 65 feet long by 19 feet beam and draws when empty about 3 feet and when loaded with 83 tons nearly 7 feet.

River Teign, Stover Canal, and Hackney Canal barges, which are mostly engaged in taking china clay from the Newton Abbot district to Teignmouth for shipment, measure about 56 feet long by 13 feet 6 inches beam and carry 30 tons, with a draft of about 3 feet forward and 3 feet 9 inches aft.

(*a*) 1. The relative use of self-propelled vessels and towed vessels.

Self-propelled vessels are not used to any considerable extent. It has been found that they are not economical for carrying traffic on the canals, owing to the restricted sectional area of the waterways; where they are used, as on the Grand Junction Canal, they carry from 16 to 18 tons of cargo and tow a "butty" (a narrow boat). The bulk of the traffic on canals is carried in horse-towed boats, but with an improvement in the locks and sectional area mechanical traction will advance.

The great bulk of the traffic on the Manchester Ship Canal is carried by ocean-going steamers. Small coasting steamers navigate the canal without the aid of any tug, but the large ocean steamers are usually assisted by tugs for steering purposes.

In South Wales there is but one self-propelled canal boat. The Glamorganshire Canal Company has a fleet of about 140 boats drawn by horses, and has only one freight-carrying steam tug. Its load is 16 to 18 tons and it tows twelve barges, each containing an average load of 20 tons.

In Lancashire, on the Leeds and Liverpool Canal, steam tugs and steam cargo boats are employed for the towing of ordinary boats, while on the same canal horses are used in Yorkshire.

On the Aire and Calder Navigation towed or hauled boats are generally used.

On the Severn, from the seaboard to Worcester and Stourport, lighters are used, namely, a long boat of about 14 feet beam with a carrying capacity of 120 tons. These vessels are towed by tugs from Gloucester to Stourport, one tug frequently bringing seven or eight lighters or barges at a time, but a tow of a mile long has been known. Although the Severn has nominally 10 feet of water from Worcester to Gloucester, the greatest draft of these vessels is 8 feet 6 inches. The tide brings mud and prevents the full 10 feet from being obtained at all times. About two motor boats are used from Gloucester to Evesham in Worcestershire on the River Avon, an important center for fruit growing not far from Birmingham. These motor boats have a capacity of from 70 to 80 tons.

On the canals around Birmingham there is a motor boat used which is run by a motor using petroleum. This has a 15-horsepower 2-cylinder motor using a low-grade kerosene, and the boat works with very little vibration. It is capable of carrying about 34 tons, but is loaded to only 26 tons because so many canals need dredging. It has a 44-gallon kerosene reservoir over the screw, and carries in

addition a 44-gallon barrel of oil, and when loaded makes 4 miles an hour, which is about 1½ miles faster than the horse or mule propelled boats. Even when pushed to 6 knots an hour it does not wash the canal banks. This boat is used for carrying timber from Sharpness on the coast to Birmingham and back, a distance of 150 miles. The cost of running it, including engineer and assistant, works out at 1d (2 cents) per ton per mile, so that the cost of operation for a trip to Sharpness and back is £1 5s. ($5.08).

On the Birmingham Canal the canal boats have a capacity of from 30 to 35 tons, and are generally towed by horses and donkeys—one horse doing the work of two donkeys. Steam tugs are, however, employed on the Worcester and Birmingham Canal for a distance of 16 miles.

In the immediate vicinity of Birmingham towed vessels, it is stated, are more used than the self-propelled vessels, but on a portion of the Severn the self-propelled boats are about as numerous as those that are towed. When vessels are towed it is usually by a tug on that waterway.

The vessels that are used on the River Trent are of three classes: (*a*) Boats of about 100 tons capacity, working between the ports on the Humber; (*b*) open lighters, which relieve the last-mentioned boats when the depth of water renders this necessary; (*c*) narrow boats, working between Nottingham and other places on the upper portion of the Trent and down the narrow canals running further inland.

Upon the River Mersey a considerable variety of boats are used, which may be divided into the following four classes: (*a*) Large barges of from 800 to 1,200 tons capacity, requiring to be towed; (*b*) the larger number of barges are from 120 to 350 tons, which also have to be towed; (*c*) barges of from 120 to 180 tons, which are wind-propelled or driven; (*d*) some propelled barges with a capacity of from 120 to 150 tons, which are steam-propelled and capable of towing other barges. The proportion of self-propelled vessels to towed vessels would be as 1 to 4.

Upon the River Thames a great many lighters are used. Their dimensions are about the same as those of the barges, but they do not travel far away from the river. They possess this advantage over barges, that they are less liable to be damaged, most of them having no helm. When they are equipped with helms they are termed "rubber punts."

(*a*) 2. Motive power for barges and canal boats.

The motive power generally used for mechanically-propelled boats is steam. Experiments have been made, and are still in progress, with suction gas, oil, and petrol, but so far it is claimed steam has given the highest efficiency and has proved to be more economical and convenient in working. Upon the rivers sailing boats are also used.

(*a*) 3. Size and draft of vessels.

There are three principal types of vessels used upon canals in the United Kingdom.

1. The narrow or "monkey" boat, which is the most generally used, and navigates with varying loads on all of the canals throughout England and upon some other navigations. The dimensions of

this boat are: Length, 72 feet, beam 7 feet, draft 3 feet 6 inches to 4 feet. It carries from 30 to 40 tons.

2. The "wide boat," which is a type of boat of a size and capacity intermediate between the narrow boat and the barge. Its dimensions are: Length from 65 feet to 72 feet, beam from 10 feet to 12 feet, and draft from 2 feet to 4 feet. It carries from 30 to 50 tons.

3. The barge, a type of vessel principally used on the River Thames and canals connected therewith. Its dimensions are as follows: Length 72 feet, beam 14 feet, and draft 4 feet 6 inches. It carries 80 tons on canals, and 100 tons on rivers, with a draft in the latter case of 5 feet.

The canal boats used in South Wales have a carrying capacity of about 20 tons. The size and draft of the boats on the various canals in said section are as follows:

| | Length. | Width. | Draft. | Height. |
|---|---|---|---|---|
| | *Ft. in.* | *Ft. in.* | *Ft. in.* | *Ft. in.* |
| Glamorganshire Canal | 60 0 | 8 9 | 3 0 | 6 6 |
| Brecon and Abergavenny Canal | 64 9 | 9 2 | 3 0 | 5 10 |
| Monmouthshire Canal | 64 9 | 9 2 | 3 0 | 5 10 |
| Swansea Canal | 62 9 | 7 6 | 3 0 | 7 0 |
| Neath Canal | 60 0 | 9 0 | 2 9 | 6 0 |
| Tennant Canal | 60 0 | 9 0 | 2 9 | |

Upon the Manchester Canal steamers of upward of 500 feet in length between perpendiculars, about 60-foot beam, drawing 27 feet, and with a dead-weight capacity of upward of 12,000 tons, are very largely employed.

In Scotland on the Firth of Clyde, navigation admits boats 66 feet in length and 7 feet in draft. The Crinan Canal admits of boats 88 feet long by 20 feet beam and 9 feet draft.

The Caledonian Canal will accommodate boats 160 feet in length, 38-foot beam, and 15 feet in draft; the River Clyde will bear the largest ocean-going ships as far up the river as Glasgow.

Boats 72 feet long, with a beam of 14 feet 4 inches, are used on the Liverpool and Leeds Canal through the long locks; and through the short locks boats 62 feet long, with a beam of 14 feet 4 inches, are used. The drafts vary in different sections of the canal from 3 feet 3 inches to 4 feet 6 inches.

Upon the Rochdale Canal barges are used 70 feet long, beam 14 feet 2 inches, and working draft 4 feet; also narrow boats 70 feet long, beam 7 feet, and 4-foot working draft.

Upon the Aire and Calder navigation boats are used 120 feet long, beam 17 feet 6 inches, and draft 7 feet 6 inches.

The character of the vessels used on the River Mersey has already been described, but it may be added that the 1,200-ton vessels referred to draw 12 feet of water when loaded; the 300-ton vessels about 10 feet; the 150 to 200 ton vessels about 9 feet; and the smaller vessels about 8 feet.

(*a*) 4. The use of iron, steel, and wood in vessel construction.

Wood in the past has been chiefly used for the construction of all types of vessels, but steel is now being used to some extent, and will, it is believed, be more and more employed.

A boat constructed of steel has many advantages over one constructed of timber, though its first cost is more. It is less expensive to maintain and its displacement never varies.

From the Birmingham district it is reported that iron is used for tugboats, wood being mostly used for barges or lighters and canal boats. Steel, it is said, is not used at present, but it is predicted that it will be in the very near future.

In Scotland, it is stated, that the use of iron or steel in the construction of vessels used on the rivers and canals of that country is, approximately, 80 per cent steel and 20 per cent wood.

On the Manchester Canal the vessels are of the ordinary seagoing type. Steel is generally employed.

Upon the Leeds and Liverpool Canal, iron, steel, and wood are all used, but the proprietors of that company state that they have found wood to be the most suitable.

While iron, steel, and wood are all used on the River Mersey, wood is most generally employed, although within recent years steel and iron vessels have been introduced. At the present time there are probably on that navigation 40 boats built of wood to 1 constructed of steel.

Without giving further illustrations, the situation at the present time is this: That on the majority of the canals and rivers of the United Kingdom a greater proportion of wooden boats are used than those of steel construction, but the experts are of the opinion that steel is preferable to wood, and believe that there will be an increasing recognition of this fact. The original cost has been the principal obstacle to its more general employment.

(*a*) 5. The cost of various types of boats.

The reports received from different portions of the United Kingdom vary so much in reference to the cost of the various types of boats that I deemed it advisable to obtain information upon this point from one who has had a very large experience, being the manager of probably the best conducted canal system in England, and who has had occasion from time to time to build practically every type of boat that is used on British canals.

The following are his estimates:

A narrow boat constructed of timber costs, fully equipped for working, from £125 to £137 ($608 to $666).

A similar boat built of steel costs £140 ($681).

A cargo-carrying steamer of the narrow type built of steel, equipped with engine and boiler, costs £800 ($3,893).

A wide boat built of timber, fully equipped, costs from £180 to £220 ($876 to $1,070), according to capacity.

A barge constructed to carry from 80 to 100 tons, if built of timber and fully equipped, costs from £300 to £350 ($1,460 to $1,703).

A barge of like capacity constructed of steel, with a view to the highest efficiency that can be secured on British canals, fully equipped with all gear for working, costs £600 ($2,920). This type of boat is now used to a very limited extent.

A narrow boat train steamer and five boats, it is estimated, will cost £1,500 ($7,300), the value of each boat being placed at £140 ($681) and the steamer at £800 ($3,893). The total capacity of this fleet would be 220 tons.

A wide boat train steamer and two boats would cost £2,400 ($11,680), the value of each of the boats being £600 ($2,920) and the steamer £1,200 ($5,839). This fleet would have a total capacity of 220 tons.

The cost of one 200-ton steamer and two 250-ton vessels would be £10,500 ($51,098), the steamer costing £4,500 ($21,899) and each of the boats £3,000 ($14,599). This fleet would have a capacity of 700 tons.

One 250-ton steamer, with a capacity of 250 tons, would cost £3,300 ($16,059).

One 350-ton vessel, with a capacity of 350 tons, would cost £1,750 ($8,516).

The following estimates of cost have also been submitted: Steam barges, steel, approximate cost £1,100 ($5,353). Dumb barges, wood, approximate cost £500 ($2,433). Dumb barges, composite, approximate cost £600 ($2,919). Narrow boats, steel, approximate cost £150 ($729). Narrow boats, wood, approximate cost £130 ($632).

The motor canal boat used on the Birmingham Canal costs £250 ($1,216), and the type of steam tug which is used on that canal costs about £400 ($1,946).

The cost of the cabin barge used on the canals in South Wales is stated to be £90 ($438); that of the deck barge £85 ($413), and that of the open barge £80 ($389).

(*a*) 6. The use of special types of boats for particular cargoes and on different classes of waterways.

The principal types of boats used on the canal and waterway systems of the United Kingdom have already been fully described.

There is a special type of boat used by the Aire and Calder Navigation Company for conveying the coal for shipment to Goole. It may be described as having the appearance of an oblong box constructed of steel, 20 feet in length, 16-foot beam, and 7-foot draft, with a carrying capacity of 40 tons. These boats are towed by a steam tug in trains of from 30 to 40 at a time. On arriving at their destination they are lifted out of the water by special machinery and tipped so that the coal is shot through on chutes to the ship's bunker.

Another special type of vessel is used to a limited extent on the River Weaver. It is termed a "Weaver flat," and is about 90 feet in length, 21-foot beam, and draws 10 feet 6 inches of water when loaded with 250 tons. Some of these boats are fitted up as steamers, and when thus equipped they carry about 250 tons. They are used for conveying salt from Northwich to the River Mersey.

In the Bradford district compartment boats are largely used for the conveyance of coal and other merchandise and minerals. These boats are about 20 feet long, 15 feet 6 inches wide, and 8 feet deep, and carry about 40 tons. They are coupled together and work in trains of about 20.

There is a special type of barge used on the River Mersey which has been introduced by the Liverpool Barge Coaling Company, and is known as "Clarke's automatic coaling barge." It is devised for carrying and automatically supplying large quantities of coal to ocean liners. It is fitted with special apparatus for discharging the coal into the hold or bunkers of a steamer.

Upon the Manchester Ship Canal steamers are used which are specially constructed for the banana and oil trades. Some of the ocean-going steamers using that canal have refrigerating chambers for carrying frozen cargo.

In Scotland no special types of boats are used; the average boats are constructed for conveying general cargo.

In South Wales there are three types of barges, namely, the cabin barge, which is covered in for perishable goods and has accommodation for the crew; the deck barge, which is generally used for the tin-plate traffic, and is covered, but has no accommodation for the crew; and the open barge, which is used for the stone, timber, granite, patent fuel, and what may be termed the rough trades.

(*a*) 7. The size of fleets of barges.

Upon river navigation the size of the fleets of vessels is practically unlimited, the determining factors being convenience and speed. Twenty vessels of varying size and capacity are frequently towed behind one tug. The determining factor as to the size of the fleet of barges on canals is the capacity of the locks.

On what are known as barge canals in England and Wales, 2 narrow boats form the fleet ordinarily, except on long level reaches when 8 or more vessels are towed in line ahead.

On boat canals 1 narrow boat only passes at a time, towage being done in that case by horses.

On the Birmingham canals the fleets of barges vary from 7 to 20, the average being 7 or 8.

In Scotland fleets of barges are stated to vary in number from 6 to 80 vessels.

Upon the Manchester Ship Canal the barges are generally towed in strings varying from 4 to 8 in number.

Upon the Leeds and Liverpool Canal the maximum length of a fleet is 5 boats.

In the Bradford district the size of the fleet of barges varies from 2 or 3 to 8 or 9 in tow with one tug.

(*a*) 8. Is the type of boats adapted to low-water stages or are they constructed with a view to utilization in high water?

All types of boats are constructed with a view to their economical working and to the circumstances of traffic, the depth of water and width of locks on the canals upon which they are used necessarily affecting their construction. Speaking generally, there is only a very slight seasonable alteration in the depth of water on English canals.

In Scotland practically all boats are adapted for deep water, and many of them go from inland points on canals and rivers to deep sea, discharging their cargoes at coast points, or to transatlantic or tropical liners. A specific example of this is shown in the case of the Forth and Clyde Canal, where small sea-going steamers load at Grangemouth on the canal, and proceed through it across Scotland, and thence to Belfast on the Irish coast, or loading at Glasgow they cross Scotland through the canal and discharge their cargoes to ocean-going vessels at Grangemouth Harbor on the Firth of Forth.

All the barges on the River Mersey are capable of working at any stage, whether low or high, if there is sufficient water for them to float alongside. Most of the barge traffic of this river is carried on within

the docks, and from one side of the river to the other, and to and from stages and piers in the river itself.

In the Bradford district most of the boats are adapted for both shallow and deep water, there being frequently a difference of 1 foot 6 inches in the draft of the same boat on different waterways.

In this connection it might be stated that the consensus of opinion of traders and canal proprietors is that a reasonably small unit boat is preferable to a large unit. It is more adaptable, travels faster, and is more economical to navigate when working collectively, besides suiting the requirements of a large number of traders.

There are also the important questions of capital expenditure, working cost, and maintenance charges in respect of an artificially constructed waterway; these considerations have to be borne in mind when considering the size of the unit to be employed, as these factors determine the toll it is necessary to charge for the use of the navigation. The toll on any improved canal will be a high proportion of the freight rate, assuming, of course, that the construction or improvement is not done by a free grant of moneys.

## IV. Ownership of Vessels and Business Organization.

(*a*) Do canal companies or other waterway improvement companies own and operate vessels?

The Rochdale Canal Company own and operate vessels, and in fact they have been general carriers for more than twenty years. They carry one-fifth of their gross tonnage, while the remainder is carried by private parties.

The Manchester Ship Canal own a large fleet of tugs, but they do not own cargo steamers.

The Aire and Calder Navigation own a considerable fleet of barges, as well as a very large number of compartment boats, and all their vessels are operated or towed by steam power.

In the Birmingham district, with the exception of the Shropshire Union, none of the canal companies own and operate vessels.

On the River Severn there are no trading vessels owned by the commissioners of the river, they simply having power to provide for the maintenance of the waterway and the collection of tolls.

The Aire and Calder Navigation Company, the Weaver Navigation Company, the Trent Navigation Company, and the Leeds and Liverpool Canal Company own their own vessels and act as carriers, but they do not do so to the exclusion of the by-trader.

The only canal company in South Wales which acts as carrier of traffic is the Glamorganshire Canal. It, however, allows traders to use the canal, providing their own barges and paying tolls to the canal company.

The other canal companies only act as toll takers.

The canal companies in Scotland do not own any vessels for commercial purposes. All of them, however, own "hopper" barges, which are necessary for dredging and maintaining their waterways.

The trustees of the River Clyde own a number of ferryboats, which are used on river crossings near the docks of the city of Glasgow.

The thousands of barges which ply the River Thames are not owned or operated by the Thames conservancy board, or by the port of London authority, but pay toll for the use of the navigation. The

only boats the conservancy own are (1) dredges, (2) boats for carrying materials for any necessary works, and (3) boats for inspectors. They do not own any cargo-carrying boats, nor act as carriers in trade or for trade purposes or for the public.

As a rule, however, the great bulk of the vessels which travel on the canals and inland navigations of the United Kingdom are owned and operated by what are known as "by-boatmen," carrying for trading companies, collieries, or for individuals. The "by-boatman" invariably lives on his vessel with his family, who usually assist him in his work.

(*b*) Are there important cases of consolidation of vessel owners into large corporations operating extensive fleets on inland waterways?

There are a few instances of such consolidation, but they are rare and isolated.

The Severn Canal Company, for illustration, owns and operates 30 boats and does most of the carrying between Birmingham and Gloucester, and Messrs. Fellows, Morton & Clayton, of Birmingham, operate a fleet of from 50 to 70 boats from Birmingham to London.

These companies, however, do a very small proportion of the carrying on the navigations which they use.

In Scotland, it is stated, there are no cases of consolidation among owners of vessels to operate extensive fleets.

There are several prominent shipping companies who own lines of vessels carrying general cargoes from and to various canal and coast points.

In Wales no such consolidations have taken place.

The Rochdale Canal Company has acquired the business of two large carriers feeling that it was more profitable to do the work themselves than to leave it in the hands of independent companies.

Some of the colliery companies own a number of barges, but they are operated solely for their own benefit, and therefore are not cases of consolidation.

The fact remains, as already stated, that there are comparatively few large fleets of vessels operated by private companies, most of the carrying being done either by owners of a single boat, or a very few boats, not a sufficient number to be dignified by the name of a fleet.

(*c*) To what extent are vessels owned and operated by railroads or by producing and distributing concerns, such as coal, oil, lumber, ore, etc., fleets?

Railroad companies, except in rare instances, do not own and operate boats for conveying traffic from centers of manufacture to the various ports in the United Kingdom.

The boats owned by the various companies are almost entirely used for the collection or delivery of merchandise at terminal points for conveyance to or from their respective railways; neither are boats owned or operated to any considerable extent by producing and distributing concerns, except that the proprietors of many of the large coal mines and flour and other mills provide their own transportation facilities.

In the Bradford district, which covers the Liverpool and Leeds Canal and the Aire and Calder navigation, there are no boats owned by the railway companies, but colliery proprietors, millers, and other large producers own and operate their own fleets of vessels. This

same condition of things prevails on most of the canals and inland navigations of England and Wales.

The London and Northwestern Railway and the Midland and Great Western railways own a few boats, which are used on the Birmingham Canal navigations; and the Shropshire Union, which is controlled by the London and Northwestern Railway has from 90 to 100 boats, and is the most conspicuous example in England of a railway which owns and operates vessels on a canal. In some instances on the Birmingham Canal navigations goods are carried by the railway companies on their own lines and by canal, but in these cases the railway company generally hires the boats from private parties. A few business concerns that are located on the canal own boats for carrying their own materials, but they form an insignificant part of the traffic of the canal.

The Caledonian Railway in Scotland owns the Forth and Clyde Canal, and the North British Railway has a small waterway called the Union Canal, which is narrow and shallow and the traffic on it is inconsiderable. The railway companies in these two cases own vessels which are used upon the canals, but not to the exclusion of traders, who are allowed to use their own boats by the payment of the prescribed tolls.

In Wales none of the railroads own the barges which are used on the canals. The only traders who own barges on the Glamorganshire Canal in South Wales are two patent fuel companies who jointly own about 100 barges. These barges are simply used for conveying the fuel over the 4 miles of canal connecting the fuel works with the docks. On the other canals in South Wales all the barges are owned by traders, each trader maintaining only a sufficient number for the purposes of his own traffic, and in no instance is there an extensive fleet of such barges owned by any producing or distributing company.

From Ireland it is reported generally that the railways in no case own or operate boats, and that there are no important instances of producing and distributing concerns which do so. The boats on the Royal Canal, which belong to the Midland Great Western Railway, are privately owned and operated.

(*d*) Are there any fleets of merchant vessels owned and operated by public authorities?

So far as public authorities are concerned they only occasionally own boats, which boats are never used for the purposes of general traffic, but simply to supply the needs of the corporation itself for the bringing of coal to gas works or electric-lighting works or for the removal of town refuse and for other strictly municipal needs.

The Thames conservancy board, as already stated, owns dredgers, boats for the use of its inspectors, and boats also for carrying materials for any necessary municipal work.

There are no cargo-carrying boats owned by any public authority in the United Kingdom.

(*e*) Are there important instances of combinations or monopolies controlling towing on canals and rivers?

This question may be broadly answered by stating that there are no combinations or municipalities which control the towing on canals and rivers in the United Kingdom.

The towage on the Manchester Ship Canal, for example, is generally performed by the canal company, which has its own fleet of tugs for that purpose, but there is no monopoly whatever.

On the Aire and Calder Navigation, and this is true on the navigations generally, both on the canals and rivers, the by-traders are allowed to tow subject to necessary restrictions as to speed, etc., to prevent damage to the banks by the wash that might result if these precautions were not provided.

In Ireland, Scotland, and Wales there is no instance of a combination or monopolistic control of towing on canals or rivers. Even when the proprietors of the waterways own their own tugs, they do not insist that these shall be used if the trader prefers to do his own towing.

## V. Terminal Facilities.

(*a*) What are the important or striking physical features of river and canal terminals, such as docks, wharves, piers, and floating wharf boats?

All canal termini have wharves, docks, or loading basins, which vary in extent according to the traffic to be dealt with.

The Manchester dock estate covers an area of 406½ acres, including a water space of 120 acres, and quays 6½ miles in length and 286½ acres in extent.

The dimensions of the Manchester docks are:

| | Feet. |
|---|---|
| No. 1 | 700 by 120 |
| No. 2 | 600 by 150 |
| No. 3 | 600 by 150 |
| No. 4 | 560 by 150 |
| No. 5[a] | 980 by 750 |
| No. 6 | 850 by 225 |
| No. 7 | 1,160 by 225 |
| No. 8 | 1,340 by 250 |
| No. 9 | 2,700 by 250 |

There is a range of thirteen single-floor, one 2-floor, six 3-floor, five 4-floor, and twelve 5-floor transit sheds, fitted with the most modern appliances, including a cold-transit shed, for the sorting of frozen meat and other produce; also 13 warehouses, 7 stories each, fitted with 27 friction hoists worked by gas engine. The docks, quays, sheds, and warehouses are lighted by electricity. Bonded accommodation is also provided.

In the Birmingham district it is reported that there are no important physical features of river and canal terminals. Many business concerns have wharves of their own, with private arms leading from the canals into the wharf. Public wharves are very little used except for the coal traffic. It is the custom in the coal trade for dealers to rent a portion of a wharf instead of securing exclusive places for their own use. The Birmingham Canal navigations own the largest wharf, which is situated in the center of Birmingham, and it rents places on this wharf to coal merchants.

On the River Trent it is stated that the termini consist mainly of business wharves and warehouses.

At all depots on the Rochdale Canal system commodious wharves and warehouses and other traffic facilities are provided.

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[a] Partially constructed.

At Glasgow Harbor on the River Clyde there are 11 miles of quayage, built almost wholly of stone, and in no instance constructed of wood. The quay walls, built in recent years, are founded in concrete masonry and faced with metallic or granite blocks. Besides the docks a greater portion of the riverside on both banks is utilized for the accommodation of vessels of all classes. A striking physical feature of the Clyde docks is shown by the fact that inasmuch as the tide rises and falls only about 11 feet there is no necessity for impounded or closed docks such as are used at many other docks. The docks are all open basins. Of the three existing tidal docks, one, the Kingston dock, has 5 acres of water space, with 830 linear yards of quays; another, a water area of about 34 acres, with 3,300 linear yards of quayage; and the third dock, which was completed in the year 1900, has a water area of 35 acres, with 3,737 linear yards of quayage.

The quays have ordinarily single and double story sheds. The total floor area of the single-story sheds is fully 24 acres, and the 2-story sheds nearly 23 acres.

The principal terminal facilities of the Forth and Clyde Canal are at Grangemouth in the east of Scotland, where opportunity is offered boats navigating the canal to discharge cargoes to ocean-going vessels or to receive shipments from them. This is a striking feature of this and of other sea-to-sea canals.

Since 1906, when improvements were made on the River Carron, the largest of steamers may now go up the Firth of Forth and pass into Grangemouth Harbor. Important from a physical standpoint among the harbor docks and appliances belonging to this canal are two timber jetties, with a combined frontage of 1,200 feet on the Firth of Forth and a 10-acre basin immediately inside the sea lock, to which ships can be moved after loading and where they can be prepared for sea. There is also a timber basin of 23 acres water area and numerous commodious warehouses and transit sheds.

(*b*) Describe the most advanced methods of loading and unloading vessels on inland waterways, including the use of mechanical appliances.

Unloading on the Liverpool and Leeds and the Aire and Calder navigations is done through the use of elevators in the case of grain and by hydraulic hoists and cranes, and steam and hand power cranes in the case of merchandise.

Upon the Birmingham Canal navigations hand labor is very generally used. A number of cranes are also employed, some of which are worked by hand and some by steam. Cranes of a 5-ton capacity are the largest in use on this navigation.

The most advanced method of unloading vessels on the River Mersey is that in use by the Liverpool Barge and Coaling Company in connection with coal only. As to loading, the only system in use in Liverpool is that of tipping the coal into barges. General cargo into and out of ships into barges is operated by the ship's own gear such as steam winches, etc. Hydraulic cranes are provided in all the modern Liverpool docks for the unloading of cargoes.

The Manchester Ship Canal has an equipment which includes 53 hydraulic, 65 steam, and 91 electric cranes, with a radius of from 16 to 40 feet, capable of lifting from 1 to 10 tons to a height from the rail level of from 13 to 59 feet; also a 30-ton steam crane, 47 locomotives, 6 floating pontoons of a dead-weight capacity of 800 tons each, and all modern appliances for giving vessels quick dispatch.

There is also a pontoon shears capable of dealing with weights up to 250 tons, with a lift of 21 feet.

Upon the River Clyde regular coasting steamers use their own gear for loading and unloading merchandise, the manual labor employed being that of stevedores, whose wages are paid by the shipping companies. The port authority, however, provides steam and hydraulic cranes of all sizes, as mentioned. In the handling of coal these cranes and hoists are generally used, as they have a capacity to lift a loaded freight car, acting much upon the principle of a freight elevator. Upon the principal canals in Scotland the usual appliances for loading and unloading are employed.

The docks at Cardiff, Newport, and Swansea in Wales are provided with great lengths of railway sidings in their immediate vicinity for the storage in cars of coal waiting shipment. In these docks the shipping appliances are worked by hydraulic power.

Attention is called to pages 140 to 143 of a publication entitled "The South Wales Coal Annual, 1906," which gives a description of the Lewis-Hunter coaling crane, by which crane 4,773 tons of coal have been loaded into one vessel in ten hours. Great care is used in this rapid handling so as to prevent breakage of the coal.

Attention is also called to pages 24 to 26, inclusive, of a publication entitled "The Taff Railway and Penarth Docks" for a description of another type of coal tip. Four of these work simultaneously on one vessel. They have loaded over 2,000 tons of coal into a vessel in less than two hours.

In Ireland no advanced methods are used in loading or unloading on the canals and waterways. Ordinary hand cranes are generally used. On the lesser waterways coal on wayside wharves is unloaded by hand, and coal in bulk is either dredged out of boats by steam grabs or by buckets fixed on an endless belt, which is lowered into the boats, and as the coal is dredged out the boat is moved along.

(*c*) Are railroad tracks located on terminals of inland waterways, permitting direct transfer between railroad and water lines? Do such tracks form a belt railroad connecting all the railroads at a given port?

Railway tracks are not necessarily located at the termini of waterways, though they do exist in certain cases, as at Manchester, Liverpool, Sharpness, and other points. All canals are connected with a railway system at various points on their course, so that merchandise can be transferred from one system to the other, and at some points railways own their own docks and transshipping stations on canals, which are exclusively used by them, as in the case of the Great Western Railway Company at Brentford and at Birmingham; also the London and Northwestern Railway on the Birmingham Canal, and on the Shropshire Union Canal, and at many other points.

The Manchester Dock Railways are 80 miles in extent and completely intersect the dock estate. The total length of railways already completed at the docks and at many points alongside the ship canal is upward of 137 miles. The following railways connect with the docks: London and Northwestern, Lancashire and Yorkshire, Great Northern, Midland, Great Central, and Cheshire lines. The ship canal company's railways alongside the ship canal between Manchester and Eastham are connected with the railways of other companies at various points. Traffic can be conveyed in railway

wagons between the various loading and discharging berths at the docks and at other places on the ship canal, and over the above lines to every railway station in Great Britain. The ship canal company supplies lists of exceptional through rates (inclusive of railway carriage and ship-canal toll) for the conveyance of traffic between inland towns and the Manchester docks, which compare favorably with the rates in operation between those towns and other ports in competition with Manchester.

The railways bring the goods down to the tips, situated on various parts of the dock estate of the River Mersey. There is a railway line running from one end of the dock estate to the other, from which there are branches leading alongside the docks. Only general goods are dealt with in this manner. All the coal traffic is worked from tips.

At the port of Goole on the Aire and Calder navigation the railway tracks permit of direct transfer between railway and water lines, and the railway tracks form a belt railway, which includes all the railways at said port.

While railroad tracks are not located at terminals of the Rochdale Canal, the different railroads have their depots within a short distance from the canal and goods are carried thence by wagon.

In the case of the River Trent, while there are isolated examples of railway facilities of the kind mentioned in this question, it is only at the port of Hull that they form a belt railroad linking all the railroads at that place.

Railroad tracks are located at all terminals of the canals in Birmingham and throughout the district. In Birmingham proper the Birmingham Canal navigations practically encircle the whole city and connect with all the railways. There is no belt railroad, however, connecting the various lines of railroads. The London and Northwestern and the Midland railways come into the same station in Birmingham, and the transfer of cars from one to the other is easy, while the Great Western Railway, with a separate station, can readily transfer its trucks to either of the other railroads. The canals in Birmingham are practically freight lines connecting all the railroads, and are used by the latter when it is more convenient for them to do so than to resort to cartage.

At the Dublin terminus of the Royal Canal in Ireland, there are railroad tracks which connect with all the railways centering in Dublin. There are no railroad tracks at the termini of the other canals in Ireland.

Railroad tracks in Scotland are situated at the terminals of inland waterways, but there are no common or joint belt lines connecting the rails of all companies. At Glasgow the three principal Scottish railroad lines, namely, the Caledonian Railroad, the North British Railroad, and the Glasgow and Southwestern Railway, have termini at various ports of the harbor with connections to the quays. The sidings on the quays, however, are owned by the port authority.

In the case of the Forth and Clyde Canal the railroad tracks belong to the canal at Bowling, but at Grangemouth they are the property of the Caledonian Railroad. The North British Railroad has track facilities at both Grangemouth and Bowling, for which it pays a stipulated rental. The Highland Railroad has been granted a portion of the canal basin and quays at Inverness on the Crinan Canal.

At a few of the canal terminals railroads in Wales have constructed sidings, by which freight may be loaded from a barge to the freight car. The quantity of such traffic is extremely small and is in all cases noncompetitive—that is to say, it is only transferred to the railroad for convenience to points which the canal can not reach, and vice versa.

At the groups of ocean docks in Wales all the railroads secure direct or indirect access, and traffic is interchangeable from one railroad to another. If a railroad does not own the tracks, it has "running power" for the same. In most cases this permission to a competitive line to use rails is compulsorily extended by law on terms to be agreed upon, which must be reasonable.

At the Cardiff docks traffic can be directly interchanged between the following railroads: Cardiff Railway, Taff Vale Railway, Rhymney Railway, the London and Northwestern Railway, and the Great Western Railway.

At the Newport docks there is interchange between the Alexandra Dock and Railway Company, the Brecon and Merthyr Railway, the Great Western Railway, the London and Northwestern Railway, Taff Vale Railway, and Rhymney Railway.

A similar position obtains at Swansea, where the three leading railroads are the Great Western, the London and Northwestern, and the Midland.

(*d*) Are river and canal terminals owned by public or private interests? Are they owned at all by private railways?

River and canal terminals are mainly owned by companies operating the navigations or by private individuals.

Public bodies, however, do own docks and wharves for their own use, both on rivers and canals, as already shown.

The railroads do not own canal terminals except where they own the canal itself. They have, however, at many points on the various canal systems provided wharves or docks, and upon nearly all the rivers at the chief ports.

There are few stages on which vessels load or discharge in the River Mersey. The work is done within the docks on one side of the river or other, and all the docks in the port of Liverpool are owned by the Mersey docks and harbor board, which may be regarded in a sense as a public authority, but not entirely so by any means, as the majority of its members are elected by various trading interests and shipping companies which largely use the river, while the corporation of Liverpool has only a minority representation on the board. The docks at Garston, 6 miles from Liverpool, are owned by the London and Northwestern Railroad.

In Scotland on most of the waterways, canals and rivers alike, wharf, dock, and crane accommodations are provided by the authority or company controlling the water course. Warehouses and transit sheds are also often provided, which are either rented to the carrying companies or their use granted at a fixed charge or rental. There are also privately owned wharves and warehouses on many waterways.

The Caledonian Railroad has a part of a small dock on the River Clyde 6 miles from Glasgow. The Forth and Clyde Canal at Glasgow furnishes both docks and sheds free on payment of the company's regular canal tolls.

In Scotland, as in England, the railroads only own the canal terminals when they are the proprietors of the canal, but they have their own wharves and docks at the principal ports along the rivers.

The South Wales canal terminals are all owned by the respective railroad companies. The import and export docks, which form the principal terminal stations of the canals, are, with one exception, owned by private companies. The exception is the group of docks at Swansea, which are owned by the Swansea Harbor Trust. This trust is a public body, which is a part of the municipal administration of the city of Swansea.

What is true of the conditions which prevail in England, Scotland, and Wales also obtain in Ireland. The principal canal in that country is the Royal Canal, which is owned by the Midland Great Western Railway Company, which also owns the canal terminals. There is said to be no instance in Ireland of the ownership of canal or river terminals by any public interest or authority.

## VI. Tolls and Freight Rates.

(*a*) Are tolls charged on canals and rivers? If so, what elements are considered in framing them and what service do they cover? Are there separate tolls for boats and cargo?

Tolls are charged on all canals and some rivers in the United Kingdom and are regulated by act of Parliament.

As to the maximum rates, tolls, and charges which may be imposed attention is called to an analysis of the Canal Rates, Tolls, and Charges Order Confirmation Acts, 1893 and 1894, in Volume III of the report of the royal commission on canals and inland navigations of the United Kingdom.

The tolls actually charged by canal companies are not ordinarily the maximum tolls, but usually very much less.

There is no uniform system of charging tolls which is applicable even to the principal canal companies.

The chief elements which are considered in framing the toll schedule are: (1) Capital cost of undertaking, (2) expense incurred in maintenance, (3) working expenses, such as providing water, etc., (4) mileage owned by any particular canal.

The principal factor which regulates the toll actually charged is what will the traffic bear, and in this respect competition is an important factor. The toll includes all expenses incurred in providing the "way" by a canal company, but is exclusive of terminal charges, loading, or unloading, or haulage. Separate tolls are not charged for boat and cargo. If a boat is loaded with, say, 30 tons of cargo, it pays a mileage toll on the cargo only, no charge being made for the boat.

The canal companies have power to make a charge for an empty boat traveling on certain sections of different navigations, but no charge can be made for an empty boat returning after having delivered a cargo, in respect to which the toll has been paid.

In the port of London authority act, 1908, a boat charge, based upon capacity, has been authorized.

The disparity between the tolls charged by the several companies owning links in a through route will be found in statements Nos. 10 and 11 of Appendix 7, Volume III of the report of the royal commis-

sion appointed to inquire into the canals and inland navigations of the United Kingdom.

The carriers, or by-traders, as distinguished from the canal company, charge for the use of their boats and make inclusive charges for all the services they render. They include in their carrying charges the tolls paid to the canal company and for the loading and unloading of merchandise when they perform such services, and in some instances their charges include delivery; that is, carriage from the canal dock to the warehouses of the party for whom they are carrying.

In Scotland it is stated that the distance traveled and the classification of freight handled are the main considerations in framing the tolls on all canals and rivers. The services for which the charges are made are for the use of the waterways and terminal facilities.

Tolls are based on the tonnage of the cargoes, but unladen vessels and noncargo carrying vessels are likewise charged a certain toll based on the tonnage of the boat.

On the Caledonian Canal on all cargo-carrying steamers except as otherwise provided a through toll of 1s. 3d. (30 cents) per registered ton is charged. On the same canal on all pleasure sailing yachts a through toll of 1s. 6d. (36 cents) per ton registered is charged up to 100 tons and 1s. 4d. (32 cents) per ton over 100 tons for a through passage. The tolls for cargo vary greatly with the weight and classification of merchandise shipped.

When a toll is charged for an empty boat, it is done so on the assumption that there should be some compensation for the water used in lockage. When the toll for a loaded boat, for instance, on the Rochdale Canal amounts to less than £1 ($4.86) a charge is made for lockage of the empty boat, if so worked in one direction; also when through traffic from or to connected canals is passed at an inclusive through toll and the boat works empty in one direction the Rochdale Canal Company charges a special toll for the empty boat trip. This is true of many other canals.

No tolls are charged on rivers in South Wales, but are charged, however, on all canals. With the exception of the Glamorganshire Canal the canal companies in South Wales are only toll takers. They supply no boats and do no work either in the haulage of boats or the handling of freight. They charge for an empty barge which passes through one or more locks on the canal 2s. 6d. (60 cents). If a cargo is under Class A or B, the charge per ton per mile is ½d. (1 cent). If the cargo is under Class C or Classes 1, 2, 3, 4, or 5, the charge per ton per mile is 1d. (2 cents). The toll for the use of the wharf if loaded at wharf on the canal is for Classes A and B 1½d. (3 cents) per ton; for Class C and Class 1, 3d. (6 cents) per ton, and for Classes 2, 3, 4, 5, and 6, 4d. (8 cents) per ton. The same tolls are also charged if unloaded at a wharf on the canal.

The Glamorganshire Canal in cases where traders supply their own barges and do the loading and unloading charges the above tolls for the use of the canal and for wharfage on goods, but this canal company will, when required, supply barges and towage and perform the services of loading and unloading.

If a trader does not require the canal to load, unload, cover, or uncover, the canal company can not charge for such services, and if any such charge is included in the total rate they must make him an equivalent rebate.

In Ireland tolls are charged, as in the rest of the United Kingdom, according to the class of the commodity and the distance it is carried. On the Royal Canal in Ireland the tolls are charged merely in respect to the use of the waterway, and there are no separate tolls for boats and cargoes. On the Lagan Canal, the Ulster Canal, and the Coal Island Canal the tolls are charged on a tonnage basis for loaded boats according to the mileage. There are no tolls charged on empty boats.

(*b*) What elements enter into the making of towing rates on canals and rivers?

Purely towing rates are not made to any extent upon English canals, although they do obtain on rivers, and in such cases include the services of a steam tug and all expenses incurred in its working.

Haulage rates are usually quoted for the conveyance of merchandise either by river or canal. These rates include providing craft and labor for working and haulage, whether by horse, steam, or otherwise. It includes, in fact, all services except toll and terminal charges, if any.

Typical haulage rates will be found upon reference to statements Nos. 14, 15, 16, and 17, in Appendix 7, Volume III, of the royal commission on canals and waterways in the United Kingdom.

Towing rates on the canals and rivers of Scotland are charged when the vessel is either light or laden, on a basis of the vessel's ton register. Towing is frequently done along the Forth and Clyde Canal by horses, and the navigators of the vessels do this towing and pay the canal authorities simply a toll for the occupancy of the waterway and for the use of the terminals.

Steam tugs perform the towing services on the Caledonian Canal, on the Forth and Clyde Canal at Grangemouth, and upon the River Clyde.

The towing charges on these various waterways are as follows:

Towing inward or outward from berth in docks to Carron road on the Forth and Clyde Canal at Grangemouth is 2d. (4 cents) per net registered ton on sailing vessels.

On the Caledonian Canal for any distance from 5 to 10 miles, 3d. (6 cents) per ton register of vessels, light or laden.

Upon the River Clyde from Glasgow to Greenock, 22½ miles, 7d. (14 cents) per ton for vessels of under 10-foot draft, and proportionately higher for vessels of greater draft for same distance.

In Wales goods under Class A (see classification of merchandise traffic, arranged by an act of Parliament, p. 13), which includes coal, coke, limestone in bulk, manure, sand, stone and undressed material for the repair of roads, rough stone from a quarry, clay in bulk, waste sulphate of lime, etc.; if barge and towage are provided by the trader, a charge of ½d. (1 cent) per mile per ton is made. If the barge and towage are provided by the canal company the charge is doubled.

In Class 1 if the trader does the work he pays 1d. (2 cents) per ton per mile, and 6d. (12 cents) per ton per mile, and 9d. (18 cents) at each end for wharfage.

The charge on the Grand Canal in Ireland for towing is 1s. (24 cents) per mile. The Royal Canal has no towage rates. The Lagan Canal Company, the Ulster Canal Company, and the Coal Island Canal Company do not haul lighters on their canals.

The secretary of the royal commission on the canals and inland navigations of the United Kingdom informs me that towing is not the subject of separate charges of British waterways save in a few unimportant instances.

(c) Do inland water lines have regular schedules of freight rates and classifications of freight? Are the rates stable or do they vary frequently with traffic exigencies?

The rates vary on different waterways because, as already stated, on the majority of waterways the companies are not carriers and the carriers, whether they are companies or individuals, are not subject to a control of their rates as the canal companies are. Consequently there is no system among by-traders, and the rates can not be said to be stable except when the canal companies act as carriers.

By act of Parliament passed in 1888, canal companies acting as carriers were put under the same regulations as the railroad companies. Under section 24 of that act, revised schedules of maximum tolls, rates, and charges have to be submitted to and settled by the British Board of Trade. Under this provision schedules of maximum tolls, rates, and charges were framed for 149 canals, and subsequently confirmed by Parliament in fifteen acts which were passed in 1893–94.

It is thought by many that this regulation, putting canal companies which acted as carriers under regulations not applicable to private individuals who carry, has discouraged canal companies from acting in that capacity.

All questions of inequalities or undue preference that may be insisted upon when the canal company acts as a carrier can be adjudicated in the manner already set forth in this report.

In the case of the Aire and Calder Navigation, which is a carrying company, it is stated that the rates are very stable, especially since they were largely reduced by act of Parliament.

In the case of the Birmingham navigations, it is said that the carriers fixed the rates and that they depend upon competition, and are steady and so fixed as to be lower than the railroad rates when the canal tolls permit.

In the case of the canals controlled by railroads, and this is true throughout the United Kingdom, the tendency is for canal tolls to be kept as near as possible to the maximum allowed by the act of Parliament chartering the canal companies. The rate for lumber, for instance, on the Birmingham navigations has remained unchanged for years.'

Upon the Liverpool and Leeds Canal the rates are fixed rates, as it is a carrying company, and they are based upon the character of the commodity and the distance traveled. Special rates are occasionally given.

The Grand Canal Company, in Ireland, has regular rates for each station using the general railroad classification list of goods. Variations in these rates occur when there is keen competition by rail or sea. Very few of the canals in Ireland, however, act as carriers themselves.

In Scotland it is reported that the inland water lines are in no instances carriers and consequently do not publish freight rates. Such rates are made and fixed by the private carriers.

With the exception of the Glamorganshire Canal none of the canal companies in South Wales and Monmouthshire perform any services other than to keep their canals open. They charge, as a rule, for this service the maximum toll. The Glamorganshire Canal, which acts as carrier charges in nearly every case a rate equivalent to railroad rates between the same points, but this is an exception to the general practice.

The following table gives the rates between Cardiff docks and the three other points on the Glamorganshire Canal, to which traffic is conveyed:

| From Cardiff docks to— | Miles. |
|---|---|
| Taffs Well | 8 |
| Pontypridd | 14½ |
| Abercynon | 16 |

*Rates from Cardiff docks by canal, per ton.*

| Merchandise. | Taffs Well. | | Pontypridd. | | Abercynon. | |
|---|---|---|---|---|---|---|
| | s. d. | | s. d. | | s. d. | |
| Grain | 2 3 | $0.54 | 2 11 | $0.71 | 3 6 | $0.85 |
| Timber | 2 6 | .61 | 3 6 | .85 | 4 3 | 1.03 |
| Cement | 2 6 | .61 | 3 4 | .81 | 3 10 | .93 |
| Stone | 1 4 | .32 | | | | |

(*d*) 1. How are inland waterway rates affected by distance of haul?

The shorter the distance, the higher the rate charged. This fact is primarily due to the tolls incurred in loading and unloading cargo, and the powers of all canal companies to charge a high toll per ton per mile for the first mile or period of miles, namely, a short-distance charge. The toll decreases with the increase of the distance traveled. When a boat is once loaded and under way the cost of haulage is very low, and in many cases toll ceases to be charged by the canal company when a certain distance has been traveled.

Back loading also has an important bearing upon haulage rates. A by-boatman when he has loaded in the Midlands of England and has traveled south, say, 120 miles, will convey the same class of merchandise to a London port, a farther distance of 30 miles, for the same rate per ton as charged for the lesser distance, provided he can obtain a return freight in a reasonable time.

Parliament has prescribed certain stages in the transit of both toll and freight traffic, at the end of which the toll or rate per ton-mile diminishes to a specified minimum.

As the carrying on canals and rivers in the United Kingdom is usually done by by-traders or carriers, the rates, outside of the toll imposed for the use of the waterway, are fixed by private arrangement.

(*d*) 2. How are inland water rates affected by quantity of commodity offered?

The quantity of the commodity offered has an important bearing upon rates from the trader's standpoint, and canal companies who are toll takers only often give drawbacks of toll by a guaranty of the quantity to be conveyed.

(*d*) 3. How are inland waterway rates affected by speed?

The rate of speed does not ordinarily affect the rates charged.

(*d*) 4. How are inland waterway rates affected by character of commodity?

The character of the commodity affects rates owing to classification; merchandise in cases, barrels, flax, rags, hay, straw, manure, timber, etc., pay a considerably higher rate per ton than mineral traffic. In the case of the latter merchandise, a boat can invariably be loaded to its maximum capacity, whereas in the case of the former articles the vessel's tonnage capacity is restricted, and consequently a higher toll and haulage rate is charged.

The value of the commodity carried is also in some cases considered, but the difference is chiefly made by the carrier who performs special services in respect of high-class traffic.

The classification of merchandise is said by one of the most distinguished canal experts in England to be unnecessary in the case of a canal company who are toll takers only. Uniformity of toll should be the rule, two distinctions only being necessary, namely, the amount of toll to be charged for short distance traffic and the amount to be charged for traffic traveling a long distance, with a minimum rate charge in either case, since the cost to a canal company of passing a boat does not vary with the character of the commodity on board, but according to its lading.

Upon the Birmingham Canal the rates vary from 5s. ($1.22) per ton on lumber by the boat load to 9s. ($2.19) per ton on general merchandise.

The extremely small traffic carried on canals in Wales is charged at the same rates whatever the conditions of distance, volume of traffic, or speed of transport.

(*e*) Do prorating arrangements exist between water lines and railroads, and to what extent?

Prorating arrangements between canals and railroad companies do not exist, but the canal companies believe that they would be most desirable. They believe this because they claim that English railroad companies do not encourage, but do everything to discourage, waterway traffic, even upon the canals which the railroads themselves own.

(*f*) How do inland water rates affect railroad freight rates? Are railroad freight rates to water-competitive points higher than to interior nonwater points of similar distances? Compare inland water rates with paralleling railway rates for short and for long distances.

A waterway company in private hands, and in competition with a railroad has the effect of reducing railroad rates. The railroad rates to water-competitive points are considerably lower than to points of similar distance which have no waterway connections; for instance, the rate by rail on a particular commodity has been reduced through water-competition 50 per cent.

Attention is specially called to the testimony on this point which was given before the royal commission on canals and waterways, in Appendix 15 of Volume I of their report.

Also to statement No. 1, Appendix 22, Volume III.

Also to statements Nos. 3, 4, 5, 6, and 7, Appendix 32, Volume III.

Also to statement No. 2, Appendix 43, Volume III.
Also statement No. 3, Appendix 7, Volume V.
Also to statements Nos. 1 and 2, Appendix 8, Volume V.
And to statement No. 1, Appendix 12, Volume V.

In the carriage of freight between Birmingham and London canal competition materially affects railroad rates. The Birmingham Canal Company is not owned by a railroad company, but the London and Northwestern Railway controls it, and for practical purposes it may be regarded as a railroad-owned canal.

The distance from Birmingham to Bristol by canal is 84 miles, and from Birmingham to Liverpool 91 miles. The distance from Birmingham to London by rail is 113 miles. The waterway system from Birmingham to Bristol is free from all railroad control. The canal system from Birmingham to London is equally free. The canals to Liverpool are, however, under railroad control.

The rates on timber, lumber, and grain are practically the same, there being perhaps 1d. (2 cents) difference between them. The rate on timber from Bristol to Birmingham is 7s. 10d. ($1.90) per ton, a distance of 84 miles. The rate on timber from Liverpool to Birmingham, a distance of 91 miles, is 13s. 4d. ($3.24). The rate on timber from Birmingham to London is 13s. 4d. ($3.24), the same as from Liverpool to Birmingham, yet the distance is 12 miles greater. Thus on the canal system from Liverpool to Birmingham, which is under railroad control, the rate is 5s. 6d. ($1.34) more than from Bristol to Birmingham, though the distance is only 7 miles more, and the rate is the same from Liverpool to Birmingham as from Birmingham to London, and the distance is 12 miles more.

It will thus be seen that the relation between the rail and water lines is one of active competition.

In Ireland for short distances the canal rates are the same as the railroad rates, but for long distances the canal rates are from 5 per cent to 12 per cent below the rates charged by railroads, and the railroad rates to competitive points are lower than to other points of equal distance where there is no competition.

The following table shows a comparison of rail and canal rates per ton to Edenderry, Ireland, from the towns mentioned, the rates from Dublin being local rates and the other rates being through rates:

IRON.

| From— | Distance. | By rail. | | By canal. | |
|---|---|---|---|---|---|
| | *Miles.* | *s. d.* | | *s. d.* | |
| Dublin | 37¼ | 9 2 | $2.23 | 5 10 | $1.41 |
| Liverpool | 175 | 20 0 | 4.86 | 13 4 | 3.24 |
| Leeds | 273 | 37 6 | 9.12 | 26 8 | 6.49 |

TIMBER.

| | | | | | |
|---|---|---|---|---|---|
| Dublin | 37¼ | | | 4 11 | $1.19 |
| Liverpool | 175 | 13 6 | $3.28 | 12 6 | 3.04 |

HARDWARE.

| | | | | | |
|---|---|---|---|---|---|
| Dublin | 37¼ | 13 4 | $3.24 | (a) | (a) |
| Manchester | 231 | 48 4 | 11.75 | 46 3 | $11.25 |

a In casks, 6s. 6d. ($1.58); other, 11s. 4d. ($2.75).

SUNDRIES.

| From— | Distance. | By rail. | | By canal. | |
|---|---|---|---|---|---|
| | *Miles.* | *s. d.* | | *s. d.* | |
| Dublin | 37¼ | 13 4 | $3.24 | 11 4 | $2.75 |
| Liverpool | 175 | 31 8 | 7.70 | 29 7 | 7.20 |
| Leeds | 273 | 55 0 | 13.38 | 52 11 | 12.88 |

DRAPERY GOODS.

| | | | | | |
|---|---|---|---|---|---|
| Dublin | 37¼ | 13 4 | $3.24 | 11 4 | $2.75 |
| London | 371 | 71 8 | 17.43 | 69 7 | 16.93 |

It will be noted that in every case quoted the rates by canal are lower than the rates by rail. In the through traffic the canal rates only enter in the matter from Dublin to Edenderry, a distance of 37¼ miles.

Other typical illustrations are given in the testimony before the royal commission already referred to showing that the railroad rates are uniformly higher where water competition is lacking. The rates throughout the United Kingdom are from 20 per cent to 30 per cent lower where there is water competition than when it is absent.

(*g*) What is the general attitude of rail and water lines toward each other? Is there active competition, or are there agreements for the division of the traffic?

The general attitude of rail and water lines toward each other is competitive where canals are free from railroad control. There are no agreements for the division of traffic.

Owing to the fact that many of the canals in the collecting areas of traffic, as well as important links in through routes, are in the hands of railroad companies, they use their commanding position, it is claimed, to inflict injury to the canal system generally by discouraging traffic on the waterways.

In Wales, it is said, railroads are unaffected by the canals, which are small and unimportant, and the competition is insignificant. There is active competition where railroads and coast routes connect the same points.

The only exception to the general condition of things stated in this answer is in the case of the Grand Canal Company, in Ireland, which has at present working agreements with the Midland Great Western and the Great Southern and Western railways. The agreement or arrangement with the Great Southern and Western Railway is, briefly, that so far as rates are concerned the companies came to an agreement that they would not reduce rates without letting each other know or without consulting each other. As regards traffic, the Grand Canal Company surrendered the business it was doing in carrying coal to the Great Southern and Western Railway in consideration of its receiving a certain percentage of the receipts of the railway company from coal and certain other goods. The annual amount of the percentage agreed to runs to a little over £4,000 ($19,466). On the other canals, I am informed, there is active competition.

(*h*) Is there any legislation regulating the relations between rail and inland water systems of transportation? Is there any governmental restriction on the lowering of rail rates in competition with water rates?

A railroad company can not use its funds to acquire a canal or interest therein without first obtaining an act of Parliament authorizing it to do so. Railroad companies and canal companies must agree to through rates on traffic passing over railroads and canals and must afford all reasonable facilities for the forwarding of such traffic.

In case of dispute or difficulty any trader can obtain remedy by referring the matter to the court of the railroad and canal commission.

There is no governmental control or restriction on the lowering of railroad rates in competition with water rates.

(*i*) Is it customary for shippers of goods by inland waterways to insure them, or is the risk assumed by the carrier? To what extent does this affect the freight rates?

It is not customary for shippers of goods to insure goods carried on inland waterways. The carrier ordinarily assumes this risk, and in the case of high-class traffic insures against it. The freight rate is doubtless affected where the carrier assumes the risk of insurance, but to what extent it is impossible to state.

## VII. Water-Borne Traffic.

(*a*) What is the general character of traffic on inland waterways, the principal commodities moved, the proportion and character of traffic moved in different directions, relative importance of package and bulk freight, etc.?

Attention is specifically called to Volume IV of the report of the royal commission on canals and inland waterways of the United Kingdom in which returns are given for all the canals of the United Kingdom.

There are no statistics giving the proportion and character of traffic moved in different directions or the relative importance of package and bulk freight.

The general traffic on the Birmingham navigations consists of minerals, lumber, partly manufactured iron and steel goods, such as iron or steel bars, sheets of iron and strips, and pitch, and general merchandise that does not have to be speedily delivered. An effort is also being made to obtain all kinds of freight, except those belonging to the perishable class. Consideration has lately been given to the question whether meat can not profitably be carried from Bristol to Birmingham in canal boats provided with refrigerating apparatus, and whether fruit that does not perish quickly, such as oranges and lemons, can not be carried in canal boats without loss through decay.

The traffic on the Manchester Canal is divided as follows:

Imports: Cotton, grain, timber, oil, green fruit, manure, iron, wood pulp, and paper.

Exports: Coal, machinery, textiles, salt, and iron.

Upon the Aire and Calder Navigation, and this is true of the navigations generally, the highest classes of traffic, together with perishables, are carried by railroads principally, and the heavier classes of goods which do not require rapid transit by the waterways.

In South Wales practically all the water-borne traffic consists of heavy freight. This includes coal, patent fuel, timber, copper ore, and stone. Very little grain or general produce travels by canal.

It is not possible to give any actual figures showing the proportions of each class of freight, as such details are not published and the canal companies are not willing to supply them.

In Scotland the general character of traffic on inland waterways is varied to a large degree, and merchandise of almost every description is conveyed from point to point. The principal commodities moved are coal, timber, oil, sugar, dressed meats, strawboards, iron ore, grain, provisions, fruit, and other classes of merchandise which go to make up general cargoes. Bulk freight on the Scottish canals forms the most important part of the total amount of shipping done.

On the Grand Canal in Ireland the principal traffic consists of porter, grain, malt, and round timber. On the Royal Canal it consists of coal, timber, stones, and some general merchandise. On the Lagan Canal, Ulster Canal, and Coal Island Canal it consists of coal, grain, sand, and spirits.

While as already stated there are no statistics showing the relative importance of package and bulk freight, the reports which have been received from the consular officers throughout the United Kingdom show that bulk freight largely predominates.

Upon the Grand Junction Canal, which is one of the most important canals in the United Kingdom, 68⅛ per cent of the traffic carried falls under class *a*, which includes coal, coke, iron ore, limestone in bulk, manure (street, stable, and farmyard), sand, stone, and other bulky articles; 11⅜ per cent falls under class *b*, which also covers articles mostly of bulky freight; and the balance, 20½ per cent, is made up to a considerable extent of what might be called package freight. These percentages may be said to approximately apply to the waterway traffic throughout Great Britain.

(*b*) Send official publications giving, for the last ten years, available statistics of vessel movement and traffic carried on inland waterways; also railroad traffic, tonnage, and ton-mileage.

The statistics for canal traffic are issued each ten years.

The first report appeared in 1888, the second in 1898, and the third report for 1908 has not as yet been published, but the same will be forwarded as soon as it is issued.

Volume IV of the report of the royal commission on canals and inland navigations in the United Kingdom gives the history, the extent, the capital of, and the traffic and works on all the canals and inland navigations in the United Kingdom.

The statistical abstract for the United Kingdom for each of the fifteen years from 1894 to 1908, on pages 314 to 317, inclusive, gives a table showing the length of line, the traffic receipts, and working expenses of all the railroads in the United Kingdom.

No statistics are published covering the ton mileage of railroads.

(*c*) Taking important inland water routes, does local traffic or other traffic predominate, and in what general proportion?

On the Aire and Calder navigation, coal traffic from the collieries to Goole, the port of shipment, largely predominates as compared with goods traffic passing from the various places on the navigation to that port. On the other hand, local coal traffic from the different collieries to the respective cities and towns on the line of navigation, taken in the aggregate, greatly predominates over the general traffic to the various places.

In the Birmingham district local traffic is by far the chief factor. On the Birmingham Canal navigations, the total traffic for 1905, the latest year for which returns have been secured, aggregated 7,546,453 tons, of which 6,170,233 tons was local, including traffic collected and discharged, and includes 1,106,178 boated to or from the railroad basins of the three railroads in that district.

Upon the Liverpool and Leeds Canal local traffic greatly predominates, and this applies both to the traffic arriving and discharging on the canal.

On the River Trent comparatively long-distance traffic predominates, the average mileage of the traffic carried by the Trent Navigation Company being about 70 miles.

The traffic controlling on most of the canals in Ireland, and on the Royal and Grand canals, is local. On the Lagan Canal, however, about two-thirds of the traffic is through traffic, and on the Ulster and Coal Island canals it is mostly through traffic, but the conditions on these three canals are exceptional and not typical.

In Wales practically the whole canal traffic is local.

In Scotland through traffic predominates over local traffic at an estimated ratio of four to one.

Taking the canals and inland navigation of the entire United Kingdom, the through traffic would constitute only about one-sixth of the entire traffic.

(*d*) Give a concise statement of typical conditions of labor which is employed in navition and in terminal handling, particularly with reference to wages paid.

The wages paid on the Rochdale Canal are as follows:

| | s. | d. | |
|---|---|---|---|
| Boatmen: | | | |
| Captain | 36 | 0 | =$8.76 |
| Mate | 31 | 0 | = 7.54 |
| Horse driver | 25 | 0 | = 6.08 |
| Warehouse and wharf porters | 21 | 0 | = 5.10 |
| | 24 | 0 | = 5.83 |
| Carters | 25 | 0 | = 6.08 |

These are the approximate weekly earnings.

The labor services are generally performed at the Manchester docks by the Manchester Ship Canal Company. They vary from 6d. (12 cents) to 12d. (24 cents) per hour, according to the class of work.

In the Birmingham district a man of the best type is paid 50s. ($12.16) for the voyage from Gloucester to Birmingham and return, which requires eight days. The rate of wages paid for a good man would therefore be about 43s. 9d. ($10.64) per week, although in some cases inferior men only receive 12s. 3d. ($2.98) per week.

Upon the Leeds and Liverpool Canal two men navigate the ordinary barge, and their wages aggregate 45s. 2d. ($10.99) per week; three men navigate a "fly" boat, and their wages aggregate 87s. ($21.16) per week; and four men, who also assist in loading and discharging, navigate a steamer, their aggregate wages amounting to 127s. ($30.89) per week.

The wages paid in terminal handling are on a average 22s. 6d. ($5.47) per week.

Until within the last five years labor in connection with lighterage upon the River Mersey was paid on the principle of piece work, namely, a certain rate per ton for the number of tons carried by the

lighter. This tonnage rate varies with the nature of the cargo and the distance between the port of loading and discharge and the time occupied in the performance of the work, the lowest rate being 5d. (10 cents) per ton, and the highest 8d. (16 cents) per ton. These rates were paid to the captains of the barges, who themselves paid for what assistance they might require to navigate their craft. This generally ran to the employment of one man, called the mate, per barge. Within the period named, however, a new system has sprung up, and lighter men on the River Mersey now are almost in every instance paid on the basis of wages, and in addition a small sum known as "ton money" on the number of tons carried by the barge. This is by way of inducement to get them to push on with their work. The rate of wages varies somewhat in proportion to the size of the barge, and the "ton money" also varies in relation to the length of the voyage, being between some points 1d. (2 cents) per ton, and others as much as 2d. (4 cents) per ton. If the barges are towed, as they invariably require to be, this is done at the cost of the owner. There is considerable traffic between the River Mersey and neighboring coastwise points. The barges are manned by the captain and mate, and the remuneration for their labor is on the basis of a division of the freight, and not on that of wages. In most instances the crew take half the earnings, less half the costs. In other instances the crew are paid a fixed rate, the owner paying all charges out of what remains of the total freight.

In Scotland three separate classes of laborers are employed in the work of navigating waterways, namely, canal laborers, seamen, and stevedores. The canal laborers have charge of bridges, lock gates, etc., and are the only persons authorized to perform services in connection with the actual operation of the canal. They receive for their services approximately 20s. ($4.86) per week. The seamen are the men employed by the owners of the vessels, and operate the boats as they proceed along the waterways. They receive from 24s. ($5.82) to 40s. ($9.73) per week. Stevedores are employed by the shipping companies and receive about 20s. ($4.86) per week, or are paid according to the amount of services rendered.

In Ireland, taking the Grand Canal Company as a standard, the laborers employed at the Dublin terminus receive 20s. ($4.86) per week. The boat crews are paid from 18s. ($4.38) to 21s. ($5.11) per week per man, while the drivers with horses are paid 16s. 6d. ($4.01) per man per week, the company owning the horses.

In Wales the laborers may be divided into three classes: (1) Men engaged in loading and unloading at wharves; (2) those who are employed in towage, which is practically all done by horses; and (3) the laborers who are engaged in tending locks and repairing the canal. The men engaged in loading are paid in some instances by the day, and in other cases by piecework. At the patent fuel works on the Glamorganshire Canal men loading fuel into barges earn, when fully employed, 8s. ($1.94) to 9s. ($2.19) per day, being paid according to the quantity they load. They do not, however, always obtain full employment, and their average wage is from 6s. ($1.46) to 7s. ($1.70) per day. The men engaged in haulage are generally paid so much per trip. Each barge has a man and a boy, and when fully employed these two together earn about 10s. ($2.43) per day. This scale applies both to men working for traders and for the canal com-

pany. The wage of men who tend the locks ranges from 17s. ($4.13) to 20s. ($4.86) per week. In addition to this wage the men are provided with a house and garden rent free.

The by-boatmen on all the waterway navigations in the United Kingdom invariably live on their vessels with their families, who assist in the working of the boat. They are an independent healthy race, honest, and upon the whole industrious.

For particulars of earnings reference is made to statements Nos. 13, 17, and 19, Appendix 7, Volume III, of the report of the royal commission on canals and inland navigations of the United Kingdom.

### GENERAL SUMMARY.

In addition to the specified answers given to the questions propounded by the department, a brief general summary of the present canal situation in the United Kingdom may prove desirable.

The great epoch of canal building in England was in the latter part of the eighteenth century, and more than one hundred canal acts were passed by Parliament before the year 1800.

With the coming of the railroads much apprehension was felt by canal proprietors in reference to the competition thereby created, and an effort was exerted, which in many cases proved successful, to induce the railroad companies to purchase canal properties and to validate such purchases parliamentary powers were secured.

There are at this time 4,053 miles of inland navigations in England and Wales. The railroad companies own absolutely 965 miles of these navigations and control 219 miles additional, while the remaining 2,869 miles are under independent proprietorship.

The railroad owned and controlled canals in 1905 carried 12,645,030 tons, while, excluding the Manchester Ship Canal, the independent canals carried 19,695,234 tons.

Since 1898 the traffic of the railroad canals has fallen off by 2,000,000 tons, and that of the independent canals has increased 500,000 tons.

The gross revenue of the railroad canals in 1905 was £3,217,615 ($15,658,523), and the net revenue £641,525 ($3,121,981).

The gross revenue of the independent canals was, in 1905, £7,934,480 ($38,613,147), and the net revenue £1,682,125 ($8,186,061).

The outlay on the English canals and navigations averages about £37,000 ($180,000) per mile.

Except in rare instances very little attention has been paid to the canals and waterways of England within the last fifty years, and within that time there has only been one important construction—the Manchester Ship Canal.

The canals and waterways carry an inappreciable fraction of the total goods traffic of the country, and very little money is being spent at this time on their improvement. Many of the smaller canals have fallen into such a condition of decay that they are for all practical purposes unavailable.

It was this condition of things that brought about the appointment of the royal commission three years ago to make a searching investigation and report on the canals and waterways of the United Kingdom with a view to ascertaining what steps should be taken to make them more profitable and serviceable.

The proprietors of, and the carriers over, the independent canals, as shown by their testimony before the royal commission, almost uniformly stated that in their opinion drastic measures should be taken to revive the canal traffic, and they urged that the railroad ownership and control of canals should cease. It was the general opinion that the Government should undertake the unification of the waterways.

The railroad managers, on the other hand, insisted in their testimony that the interior waterways could not be operated profitably in competition with the railroads, and that the railroads, instead of desiring to injure the traffic on such waterways as they owned or controlled, really desired to have them carry sufficient traffic to make them profitable instead of being compelled to operate them ordinarily at a loss.

It was the general opinion of those who testified before the royal commission that to make the waterways profitable they would have to be linked together to form one general system, that barges with a larger carrying capacity would have to be employed, and that the canals and navigations would have to be standardized and their locks and so forth reconstructed to allow the passage of larger boats, and that steam power would have to replace the use of horses.

Antagonism to this general opinion was expressed by some of the witnesses before the royal commission, who insisted that large barges could only be operated profitably when they were fully loaded, and that the delay which must occur very frequently in obtaining a full load would result in a loss of time that would be a serious detriment to the waterway navigation as competing factors with the railroads.

The most satisfactory method, it is believed by experts, of rendering the canals useful would probably be to concentrate attention upon some of the main routes, such as those connecting Birmingham and Liverpool, Birmingham and London, Leeds and Liverpool, Leeds and Hull, and to widen and deepen these canals, equipping them at the same time with mechanical haulage so as to enable the larger barges to be easily managed.

It is suggested that if electricity were used as the motive power this supply could be utilized for operating locks and lock gates, capstans, cranes, and many other auxiliary appliances in use on canals.

It is also insisted that it would be much more satisfactory if the merchandise carried on the canals was restricted, as far as possible, to such articles as coal, building material, corn, etc., which do not undergo a material depreciation in transit, and for which rapid transit is less essential than for dry goods, fruit, and other perishable articles. If this were done the rates for carriage of the heavier materials, it is thought, might be considerably diminished.

## PART II.—RAILWAY RATES IN THE UNITED KINGDOM.

### GENERAL OBSERVATIONS.

The most important acts of Parliament regulating the rates and charges on British railways were passed, respectively, in the years 1854, 1873, 1888, and 1891–92. In the legislation of the last-named years maximum rates for transports and terminals, applicable to all existing railways, were fixed.

Attention is called to a publication entitled "Railway rates, charges, and regulations of the United Kingdom," in which the maximum rates, as provided by the acts of Parliament of 1891–92, are set forth; also the terminal charges and the general conditions under which railways must carry traffic.

There is a special tribunal known as the railway and canal commission, and also a railway department of the British Board of Trade.

If a shipper considers that he is charged unreasonable rates or that a competitor is being favored above himself, he may apply for redress to the British Board of Trade. This board usually arranges for a conference between the aggrieved shipper and a representative of the railway company. At this meeting a board of trade official is present, and it frequently happens that an amicable adjustment is effected. If the conference is ineffectual, the shipper may then prosecute the matter before the railway and canal commission, whose decision is final.

It will be noticed in the tables which follow that the larger proportion of the traffic in the United Kingdom is carried at considerably lower rates than the maximum rates provided by Parliament.

Wherever the volume of traffic is large railways are accustomed to quote special rates. Such rates are lower between competitive points, and this is especially true if one of the competitors is engaged in the coastwise trade. The rates, for example, between Cardiff and Bristol are below the average, owing to the existence of a regular line of Bristol Channel steamers.

The rates charged are lower generally when there is active competition for the same traffic. When a manufacturer proposes to start a new industry, he can frequently obtain special concessions from railroads at the initial stage of the enterprise, as each railroad is desirous of procuring as much business as it possibly can.

The relations between British industries and British railways are mainly controlled by the following three factors:

1. By acts of Parliament enforced by the British Board of Trade and the court of the railway and canal commission.
2. By competition.
3. By the self-interest of the railway companies in handling traffic at rates which will encourage industrial development.

A number of the British railways, which are competitors for passenger and freight traffic, have in recent years effected working

arrangements so as to reduce operating expenses and to obviate to some extent what they consider disastrous competition. Powers have been sought through Parliament to authorize the amalgamation of certain railways, but up to this time such powers, I believe, have not been granted.

### RAILWAY FREIGHT RATES.

The secretary of the railway clearing house in London has furnished the facts which are given below, and while specific answers are not furnished to all the questions in the department's instruction in reference to railway rates, they do show the rates charged, and the conditions under which the same are imposed for the various commodities inquired of in the instruction.

Although the answer of the secretary of the railway clearing house is to the effect that special rates lower than those for inland traffic are not generally given for export business, the tables furnished from Bradford and from Cardiff (Wales), which appear subsequently, show that the export rates are usually lower than those charged for inland traffic.

It will also be noticed that in the report from the railway clearing house distances are given without the names of towns, which for some reason, it is stated, they prefer not to furnish. The rates, however, I am assured, are in each instance the rates actually charged according to the distance given.

## Question I.

### GENERAL CONDITIONS APPLICABLE TO COAL TRAFFIC.

1. The rates are specifically recorded for coal.
2. The terminal and transportation charges are combined and can not be given separately.
3. The rates are per ton (2,240 pounds) for coal in bulk, in traders' open trucks, in full truck loads.
4. No charge is made for return of the empty trucks to the collieries.
5. No conditions as to "fast" or "slow" freight are attached to the rates.
6. All the rates have been given to encourage industrial development.

*Rates and conditions for coal traffic.*

COAL FOR EXPORT.

| Distance. | Rate per ton. | | | Distance. | Rate per ton. | | |
|---|---|---|---|---|---|---|---|
| | *s.* | *d.* | *Cents.* | | *s.* | *d.* | *Cents.* |
| 10 miles | 0 | 9½ | 19 | 60 miles | 2 | 8 | 64 |
| 20 miles | 1 | 4 | 32 | 70 miles | 2 | 11 | 70 |
| 30 miles | 1 | 10 | 44 | 80 miles | 3 | 1 | 74 |
| 40 miles | 2 | 2½ | 53 | 90 miles | 3 | 3 | 78 |
| 50 miles | 2 | 5 | 58 | 100 miles | 3 | 6 | 84 |

The rates include collection from colliery sidings, standing room at destination for a reasonable period waiting shipment, and delivery alongside ship.

*Rates and conditions for coal traffic*—Continued.

COAL FOR DOMESTIC USE.

| Distance. | Rate per ton. | | Distance. | Rate per ton. | |
|---|---|---|---|---|---|
| | s. d. | | | s. d. | |
| 10 miles | 1 2 | $0.28 | 80 miles | 4 11 | $1.18 |
| 20 miles | 1 11 | .46 | 100 miles | 5 7 | 1.34 |
| 30 miles | 2 7 | .62 | 150 miles | 6 10 | 1.64 |
| 40 miles | 3 2 | .76 | 200 miles | 8 00 | 1.92 |
| 50 miles | 3 8 | .88 | 250 miles | 8 11 | 2.14 |

The rates include collection from the colliery sidings, and standing room at destination for a reasonable period.

## Questions II to V.

GENERAL CONDITIONS APPLICABLE TO MERCHANDISE TRAFFIC BY GOODS TRAINS.

1. The terminal and transportation charges are combined and can not be given separately.
2. Private siding rates only include collection by truck from and (or) delivery to the junction between the trader's private siding and the railway.
3. Station rates include the use of the station for a reasonable period.
4. Collected and (or) delivered rates include the services of collection and (or) delivery within defined areas, also use of station, loading and unloading.
5. All the rates given apply at 2,240 pounds to the ton, except those for lumber (deals, battens, and boards), which are chargeable in accordance with page 178 of the general railway classification of goods by merchandise trains.
6. The rates apply with the minimum loads specified, or, where no minimum load is mentioned, are applicable to any quantities. Consignments of 3 hundredweights or under in weight are subject to the small parcels scales as set forth in the general railway classification of goods by merchandise train. It is the practice to give rates at "per ton" and not "per truck."
7. Except where shown to the contrary the rates enumerated are specifically noted for the commodities named.
8. No conditions as to "fast" or "slow" rates freight are attached to the rates.
9. All the commodity rates have been given to encourage industrial development.

## Question II.

### RATES AND CONDITIONS FOR GENERAL MERCHANDISE BY GOODS TRAINS.

1. Iron ore for making iron, private siding to private siding, full truck loads in traders' trucks:

| Distance. | Rate per ton. | | Distance. | Rate per ton. | |
|---|---|---|---|---|---|
| | *s.* *d.* | | | *s.* *d.* | |
| 10 miles | 0 10¾ | $0.21½ | 80 miles | 2 11 | $0.70 |
| 20 miles | 1 0½ | .25 | 100 miles | 3 8 | .88 |
| 30 miles | 1 3 | .30 | 150 miles | 5 8 | 1.36 |
| 40 miles | 1 7 | .38 | 200 miles | 7 0 | 1.68 |
| 50 miles | 2 1 | .50 | 250 miles | No rates. | |

No charge is made for the return of the empty trucks to the mines.

2. Stone in the rough state, building, pitching, paving, curb, or flag, station to station, minimum load 4 tons:

| Distance. | Rate per ton. | | Distance. | Rate per ton. | |
|---|---|---|---|---|---|
| | *s.* *d.* | | | *s.* *d.* | |
| 10 miles | 2 0 | $0.48 | 80 miles | 7 3 | $1.74 |
| 20 miles | 3 2 | .76 | 100 miles | 8 9 | 2.10 |
| 30 miles | 3 10 | .92 | 150 miles | 10 10 | 2.60 |
| 40 miles | 4 9 | 1.14 | 200 miles | 13 8 | 3.28 |
| 50 miles | 5 5 | 1.30 | 250 miles | 16 5 | 3.94 |

3. Lumber (deals, battens, and boards), station to station, mimimum load 2 tons:

| Distance. | Rate per ton. | | Distance. | Rate per ton. | |
|---|---|---|---|---|---|
| | *s.* *d.* | | | *s.* *d.* | |
| 10 miles | 3 4 | $0.80 | 80 miles | 9 2 | $2.20 |
| 20 miles | 4 7 | 1.10 | 100 miles | 10 10 | 2.60 |
| 30 miles | 5 8 | 1.36 | 150 miles | 14 0 | 3.36 |
| 40 miles | 6 8 | 1.60 | 200 miles | 17 6 | 4.20 |
| 50 miles | 7 6 | 1.80 | 250 miles | 20 10 | 5.06 |

4. Fertilizers (packed manure), station to station, minimum load 4 tons:

| Distance. | Rate per ton. | | Distance. | Rate per ton. | |
|---|---|---|---|---|---|
| | *s.* *d.* | | | *s.* *d.* | |
| 10 miles | 2 8 | $0.64 | 80 miles | 8 4 | $2.00 |
| 20 miles | 3 4 | .80 | 100 miles | 10 0 | 2.40 |
| 30 miles | 4 2 | 1.00 | 150 miles | 13 10 | 3.32 |
| 40 miles | 5 0 | 1.20 | 200 miles | 16 3 | 3.90 |
| 50 miles | 5 10 | 1.40 | 250 miles | 18 2 | 4.36 |

5. Grain, station to station, minimum load 4 tons:

| Distance. | Rate per ton. | | Distance. | Rate per ton. | |
|---|---|---|---|---|---|
| | *s.* *d.* | | | *s.* *d.* | |
| 10 miles | 3 4 | $0.80 | 80 miles | 9 11 | $2.38 |
| 20 miles | 4 11 | 1.18 | 100 miles | 11 7 | 2.78 |
| 30 miles | 5 9 | 1.38 | 150 miles | 15 5 | 3.70 |
| 40 miles | 6 7 | 1.58 | 200 miles | 17 6 | 4.20 |
| 50 miles | 7 5 | 1.78 | 250 miles | 19 7 | 4.70 |

## Question III.

Special rates lower than those for inland traffic are not generally given for export business.

## Question IV.

### ILLUSTRATIONS OF TRAFFICS IN "HIGHEST GRADE OF CLASSIFIED FREIGHT."

The rates given in Clause VII of "Typical products," page 6, are illustrations of rates for traffics in highest grade of classified freight, viz, class 5. They are applicable to such articles as the following: Artificial flowers, cigars, silk, perfumery, furniture, musical instruments, furs, optical instruments, phonograph records, extract of meat.

## Question V.

### TYPICAL PRODUCTS.

1. Pig iron, private siding to station, minimum load 4 tons:

| Distance. | Rate per ton. | | Distance. | Rate per ton. | |
|---|---|---|---|---|---|
| | s. d. | | | s. d. | |
| 10 miles | 1 5 | $0.34 | 80 miles | 6 10 | $1.64 |
| 20 miles | 2 6 | .60 | 100 miles | 8 1 | 1.94 |
| 30 miles | 3 5 | .82 | 150 miles | 10 6 | 2.52 |
| 40 miles | 4 4 | 1.04 | 200 miles | 12 6 | 3.00 |
| 50 miles | 5 0 | 1.20 | 250 miles | 14 2 | 3.40 |

2. Cement, packed, station to station, minimum load 4 tons:

| Distance. | Rate per ton. | | Distance. | Rate per ton. | |
|---|---|---|---|---|---|
| | s. d. | | | s. d. | |
| 10 miles | 2 9 | $0.66 | 80 miles | 7 3 | $1.74 |
| 20 miles | 3 3 | .78 | 100 miles | 8 9 | 2.10 |
| 30 miles | 4 0 | .96 | 150 miles | 11 3 | 2.70 |
| 40 miles | 5 0 | 1.20 | 200 miles | 14 2 | 3.40 |
| 50 miles | 5 9 | 1.38 | 250 miles | 16 8 | 4.00 |

3. Paper, in bales or bundles, collected and delivered; paper, on reels for printing, at owner's risk, collected and delivered:

| Distance. | Rate per ton. | | Distance. | Rate per ton. | |
|---|---|---|---|---|---|
| | s. d. | | | s. d. | |
| 10 miles | 8 4 | $2.00 | 80 miles | 18 4 | $4.40 |
| 20 miles | 10 0 | 2.40 | 100 miles | 20 0 | 4.86 |
| 30 miles | 11 8 | 2.80 | 150 miles | 25 0 | 6.06 |
| 40 miles | 13 4 | 3.20 | 200 miles | 29 2 | 7.06 |
| 50 miles | 15 0 | 3.60 | 250 miles | 32 6 | 7.86 |

4. Yarn, twist, and weft, cotton and linen, in bales, bags, wrappers, cases, boxes, skips, or casks, collected and delivered:

| Distance. | Rate per ton. | | Distance. | Rate per ton. | |
|---|---|---|---|---|---|
| | s. d. | | | s. d. | |
| 10 miles | 6 8 | $1.60 | 80 miles | 21 8 | $5.26 |
| 20 miles | 10 0 | 2.40 | 100 miles | 25 0 | 6.06 |
| 30 miles | 13 4 | 3.20 | 150 miles | 28 4 | 6.86 |
| 40 miles | 15 0 | 3.60 | 200 miles | 31 6 | 7.62 |
| 50 miles | 16 8 | 4.00 | 250 miles | 35 0 | 8.46 |

5. Woolen and worsted goods, in bales, packs, or trusses, collected and delivered:

| Distance. | Rate per ton. | | Distance. | Rate per ton. | |
|---|---|---|---|---|---|
| | s. d. | | | s. d. | |
| 10 miles | 7 6 | $1.80 | 80 miles | 26 8 | $6.46 |
| 20 miles | 10 6 | 2.52 | 100 miles | 29 9 | 7.20 |
| 30 miles | 15 5 | 3.70 | 150 miles | 38 4 | 9.26 |
| 40 miles | 18 10 | 4.52 | 200 miles | 43 4 | 10.52 |
| 50 miles | 21 0 | 5.10 | 250 miles | 46 8 | 11.32 |

6. Drapery, light, as per the general railway classification of goods by merchandise trains collected and delivered:

CLASS 4.

| Distance. | Rate per ton. | | Distance. | Rate per ton. | |
|---|---|---|---|---|---|
| | s. d. | | | s. d. | |
| 10 miles | 13 1 | $3.14 | 80 miles | 32 6 | $7.86 |
| 20 miles | 15 10 | 3.80 | 100 miles | 38 5 | 9.28 |
| 30 miles | 19 11 | 4.84 | 150 miles | 44 7 | 10.82 |
| 40 miles | 22 6 | 5.46 | 200 miles | 50 0 | 12.15 |
| 50 miles | 25 0 | 6.06 | 250 miles | 56 10 | 13.79 |

7. Bicycles, packed, or if not packed, at owner's risk only, collected and delivered:

CLASS 5.

| Distance. | Rate per ton. | | Distance. | Rate per ton. | |
|---|---|---|---|---|---|
| | s. d. | | | s. d. | |
| 10 miles | 16 5 | $3.94 | 80 miles | 38 3 | $9.27 |
| 20 miles | 20 3 | 4.92 | 100 miles | 43 9 | 10.62 |
| 30 miles | 23 7 | 5.72 | 150 miles | 55 8 | 13.51 |
| 40 miles | 27 5 | 6.64 | 200 miles | 66 8 | 16.18 |
| 50 miles | 30 10 | 7.49 | 250 miles | 77 4 | 18.77 |

## Question VI.

The maximum conveyance charges authorized by Parliament are in the following or other graduations of a similar character, the rate per mile diminishing with each gradation of distance:

For the first 20 miles or any part of such distance.

For the next 30 miles or any part of such distance.

For the next 50 miles or any part of such distance.

For the remainder of the distance.

The railway companies, while in no case exceeding their maximum powers, frequently (and, indeed, usually) adopt rates lower than the figures they are entitled to charge, the various considerations affecting the traffic being taken into account.

The following information, giving detailed answers as far as possible to the interrogatories propounded in reference to the three principal railways operating in Bradford, has been furnished by Augustus E. Ingram, the consul at Bradford:

The Midland Railway Company, the Great Northern Railway Company, and the Lancashire and Yorkshire Railway Company are the three principal railways entering Bradford, each of which has terminal facilities of its own in the city of Bradford for passenger and goods (or freight) traffic, the last two companies having a joint passenger station.

The following brief extracts from the general regulations of the general railway classification of goods by merchandise trains may, however, be of service in explaining what follows:

1. Classes A and B applicable to 4 tons and upwards.
2. Class C applicable to consignments of 2 tons and upwards.
3. Classes 1 to 5: Unless otherwise provided the rates include collection and delivery within the boundaries prescribed by the companies at various places.
4. All goods are charged at the gross weight of 2,240 pounds to the ton, as ascertained at the invoicing station, except as otherwise provided for stone and timber.

Stone in blocks, when the weight can not be ascertained, is charged at the rate of 14 cubic feet to the ton.

The provisions as to timber will be stated later.

The following are certain additional general conditions and regulations that are applicable to railways in this country, the same having been agreed upon by them in conference:

1. Class rates apply to articles in the respective classes of the general railway classification of goods.
2. The rates for Classes A and B are exclusive of loading, unloading, covering, and uncovering.
3. The exceptional rates recorded is "S. to S." (station to station) and with sidings, are exclusive of loading and unloading.
4. Rates including collection or delivery cover those services only where the company have a staff for that purpose, and within the limits prescribed by the company at the various places; for collection or delivery beyond those limits when undertaken by the company additional charges are made.
5. Where the company does not perform the service of collection or delivery on traffic charged at rates noted as including those services an allowance is or may be made.

### *Question 1.—Coal rates.*

In reply to question No. 1 the following tables give, so far as possible, examples of the rates on coal on the three principal railways operating in Bradford.

(*a*) The termini are given.

(*b*) The distances of each shipment.

(*c*) It is not possible to obtain here information so as to separate the terminal and transportation charges.

(*d*) Accordingly this point must be omitted.

(*e*) Coal is, according to the general railway classification of goods, in Class A, but as is customary in this country with all commodities when there is much traffic in them a special or reduced rate is fixed.

(*f*) As to the minimum carload weight, that is stated in the accompanying tables. The freight cars seem to be made to carry about 8 tons per truck, there being a prejudice against the large freight cars in use in the United States. There is also a reduction in the rates, as will be shown in some of the accompanying tables, when the commodity is carried in the owner's wagons or freight cars instead of

in the company's wagons. There is also a reduction made, and such classes of rates are marked in the rate books "x," "y," or "z," depending on the nature of the merchandise, when it is carried at the owner's risk. There is, so far as can be learned here, no difference in rates for fast or slow freight, the same speed probably being maintained on all freight trains.

(*g*) No information has been obtainable as to the encouragement by special rates of the development of any industry beyond the somewhat general giving of special rates when the volume of business appears to justify them.

The Midland Railway Company's rates for coal could not be definitely ascertained at Bradford, for the reason that there is no record here of such rates, and all such matters are attended to at the mineral department of the railway at Derby. As coal is ordinarily placed in Class A, unless a special rate be given, the following table may be of some interest:

| Between Bradford and— | Distance. | Class A (owner's trucks) per ton. | |
|---|---|---|---|
| | *Miles.* | *s. d.* | |
| Doncaster | 49¼ | 3 6¾ | $0.87 |
| Sheffield | 51½ | 3 6 | .85 |
| Derby | 85⅝ | 6 0 | 1.46 |
| Nottingham | 90¾ | 6 2 | 1.50 |
| Widnes | 95 | 5 8 | 1.38 |
| Coventry | 123 | 8 1 | 1.97 |

The Great Northern Railway Company's rates on coal are, according to their rate book, as follows:

| Between Bradford and— | Distance. | Class A (owner's trucks) per ton. | | Special rate. | |
|---|---|---|---|---|---|
| | *Miles.* | *s. d.* | | *s. d.* | |
| Gildersome | 7 | 1 5¼ | $0.34½ | 1 4 | $0.32 |
| Tingley | 10 | 1 9½ | .43 | 1 3 | .30 |
| Ardsley | 12 | 1 11¾ | .47½ | 1 5 | .34 |
| Dewsbury | 12 | 1 8½ | .40½ | 1 7 | .38 |
| Lofthouse | 13 | 2 2¾ | .53½ | 1 6 | .36 |
| Alverthorpe | 15 | 1 11½ | .47 | 1 9 | .42 |
| Methley | 18 | 2 5½ | .59 | 1 11 | .46 |
| Nostell | 21 | 2 4 | .56 | 2 0 | .48 |
| Hemsworth | 24 | 2 7 | .62 | 2 0 | .48 |
| Basford | 98 | | | 3 11 | .95 |

In company's wagons 9d. (18 cents) per ton extra is charged.

The Lancashire and Yorkshire Railway Company state that there is no coal shipped from Bradford, and therefore their rate book contains no specific information on this matter, except the rates under Class A, of which a few illustrations are given:

| Between Bradford and— | Distance. | Class A (owner's trucks) per ton. | |
|---|---|---|---|
| | *Miles.* | *s. d.* | |
| Halifax | 8½ | 1 2½ | $0.29 |
| Holmfield | 10¾ | 1 3 | .30 |
| Dewsbury | 12 | 1 8½ | .41 |
| Horbury | 13¾ | 2 1½ | .51 |
| Wakefield | 17½ | 1 11½ | .47 |
| Hensall | 34¼ | 3 2¼ | .78 |

*Question II.—Iron ore, stone, lumber, fertilizer, grain.*

1. The following are the rates on iron ore:

The Midland Railway Company has no record at Bradford of rates on this commodity, it being necessary, if any shipment were to be made, to make application therefor to the mineral department at Derby. Under the general classification iron ore in bulk comes under Class A, and the Midland Company's rates therefor are given in answer to the previous question.

The Great Northern Railway Company's rates on this commodity are as follows, but as there is no traffic in iron ore, no special rates have been made:

| Between Bradford and— | Distance. | Class A. | | Comprised into briquettes. Class B. | |
|---|---|---|---|---|---|
| | *Miles.* | *s. d.* | | *s. d.* | |
| Leeds | 9 | 1 4½ | $0.33 | 1 11½ | $0.47 |
| Halifax | 9½ | 1 2½ | .28½ | 1 11 | .46 |
| Dewsbury | 11¾ | 1 8½ | .40½ | 2 4 | .56 |
| Keighley | 14 | 1 4½ | .33½ | 1 11½ | .47 |
| Wakefield | 16¾ | 1 11½ | .47 | 3 0½ | .74 |
| Doncaster | 35½ | 3 7 | .87 | 4 11 | 1.19 |
| Nottingham | 95 | 6 2 | 1.50 | 7 10 | 1.90 |
| Codnor Park | 107½ | 5 7 | 1.35 | 7 3 | 1.76 |
| Ramsey | 128 | 9 1 | 2.21 | 10 0 | 2.43 |
| London | 191 | | | 13 1 | 3.18 |

The Lancashire and Yorkshire Railway Company's rates on iron ore are as follows:

| Between Bradford and— | Distance. | Class A. | | Special rates for 4-ton loads, station to station. | |
|---|---|---|---|---|---|
| | *Miles.* | *s. d.* | | *s. d.* | |
| Halifax | 8½ | 1 2½ | $0.29 | | |
| Holmfield | 10¾ | 1 3 | .30 | | |
| Dewsbury | 12 | 1 8½ | .41 | | |
| Horbury | 13¾ | 2 1½ | .51 | | |
| Wakefield | 17½ | 1 11½ | .47 | | |
| Hensall | 34¼ | 3 2¼ | .78 | | |
| Liverpool | 70 | | | 5 4 | $1.29 |

STONE.

2. The rates on stone are somewhat complicated, this commodity being classified as follows:

Stone for road repairing, wholly undressed, is in Class A.

Stone for building, paving, etc., is in Class B.

Stone sawn or roughly wrought up is in Class C.

Stone carved for building purposes is in Class 2x ("x" signifying a special rate when carried at owner's risk.)

Stone decorated for interiors is in Class 4y ("y" signifying also a special rate when carried at owner's risk).

Exceptional or special rates are frequently given, as there is a large amount of this traffic.

The Midland Railway Company's rates on this commodity are as follows:

| Between Bradford and— | Distance. | Per ton. | | | | | | Special rates, station to station, 4-ton loads, Class B. |
|---|---|---|---|---|---|---|---|---|
| | | Class A. | | Class B. | | Class C. | | |
| | *Miles.* | *s. d.* | | *s. d.* | | *s. d.* | | *s. d.* |
| Keighley | 9½ | 1 4¾ | $0.34 | 1 11½ | $0.48 | 3 6 | $0.85 | 1 10 | $0.45 |
| Kirkstall | 10½ | 1 6 | .36 | 1 10 | .45 | 3 11 | .95 | 1 9 | .42 |
| Oxenhope | 14½ | 1 10½ | .46 | 2 3 | .55 | 4 9 | 1.15 | 1 11 | .47 |
| Long Preston | 29¾ | 3 2 | .77 | 3 7 | .87 | 6 6 | 1.58 | 3 5 | .83 |
| Swinton | 41¾ | 3 1 | .75 | 4 7 | 1.11 | 7 4 | 1.78 | 4 2 | 1.01 |
| Bentham | 43½ | 4 2 | 1.01 | 4 9 | 1.15 | 7 10 | 1.91 | 4 2 | 1.01 |
| Lancaster | 57¼ | 4 11 | 1.20 | 6 0 | 1.46 | 10 1 | 2.45 | 5 10 | 1.42 |
| Hawes | 59½ | ..... | ..... | 6 1 | 1.48 | 9 7 | 2.33 | 5 10 | 1.42 |
| Morecambe | 60½ | ..... | ..... | 6 3 | 1.52 | 10 5 | 2.53 | 5 10 | 1.42 |
| Buxton | 97¾ | ..... | ..... | 8 3 | 2.01 | 13 1 | 3.18 | 7 11 | 1.93 |

The Great Northern Railway Company's rates on stone are as follows:

| Between Bradford and— | Distance. | Per ton. | | | | | | | | Special rate, Class B (4-ton lots). | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class A. | | Class B. | | Class C. | | Class 2x. | | Class 4y. | | | |
| | *Miles.* | *s. d.* | | *s. d.* | | *s. d.* | | *s. d.* | | *s. d.* | | *s. d.* | |
| Leeds | 9 | 1 4½ | $0.33 | 1 11½ | $0.47 | 3 6 | $0.85 | 7 11 | $1.92 | 10 7 | $2.57 | 1 9 | $0.42 |
| Halifax | 9½ | 1 2½ | .29 | 1 11 | .46 | 3 6 | .85 | 7 11 | 1.92 | 10 7 | 2.57 | 1 9 | .42 |
| Batley | 9½ | 1 8½ | .40½ | 2 4 | .56 | 3 8 | .89 | 7 11 | 1.92 | 10 7 | 2.57 | 2 1 | .50 |
| Dewsbury | 11¾ | 1 8½ | .40½ | 2 4 | .56 | 3 8 | .89 | 7 11 | 1.92 | 10 7 | 2.57 | 2 2 | .52 |
| Keighley | 14 | 1 4¾ | .33½ | 1 11½ | .47 | 3 6 | .85 | 7 0 | 1.70 | 8 10 | 2.14 | 1 10 | .44 |
| Wakefield | 16¾ | 1 11½ | .47 | 3 0½ | .74 | 5 0 | 1.21 | 10 3 | 2.49 | 13 5 | 3.26 | 2 6 | .60 |
| Doncaster | 35½ | 3 7 | .87 | 4 11 | 1.19 | 8 0 | 1.94 | 14 3 | 3.46 | 18 7 | 4.52 | 4 7 | 1.11 |
| Nottingham | 95 | 6 2 | 1.50 | 7 10 | 1.90 | 12 3 | 2.98 | 21 1 | 5.12 | 27 7 | 6.70 | 7 5 | 1.80 |
| Hitchen | 159 | ..... | ..... | 12 0 | 2.92 | 18 9 | 4.56 | 31 8 | 7.69 | 41 8 | 10.13 | 10 10 | 2.63 |
| London | 191 | ..... | ..... | 13 1 | 3.18 | 19 3 | 4.68 | 35 7 | 8.65 | 48 6 | 11.79 | 11 8 | 2.83 |
| | | | | | | | | | | | | a10 10 | a 2.63 |

a For 5-ton lots.

In addition to these special rates, it may be said that between Bradford and Halifax there is a special rate on stone in Class A of 1s. 2d. (28 cents) in owner's wagons and 1s. 7d. (38 cents) in company's wagons for 4-ton lots.

The Lancashire and Yorkshire Railway Company's rates on stone are as follows:

| Between Bradford and— | Distance. | Per ton. | | | | Special rates (station to station, 4-ton loads), Class B. |
|---|---|---|---|---|---|---|
| | | Class B. | | Class C. | | |
| | *Miles.* | *s. d.* | | *s. d.* | | *s. d.* | |
| Hipperholme | 6½ | 1 9 | $0.42 | 3 7 | $0.87 | 1 4 | $0.32 |
| Halifax | 8½ | 1 11 | .46 | 3 6 | .85 | a 1 9 | a. .42 |
| Denby Dale | 22 | 3 6 | .85 | 5 11 | 1.43 | b 2 11½ | b. .71 |
| Facit | 34¾ | 4 6 | 1.09 | 7 5 | 1.80 | c 3 8½ | c. .90 |
| | | | | | | d 3 3½ | d. .80 |
| Manchester | 40 | 4 10 | 1.17 | 8 1 | 1.96 | ..... | ..... |
| Halliwell | 44½ | 5 4 | 1.29 | 8 4 | 2.02 | 4 11 | 1.19 |
| Chorley | 50½ | 5 8 | 1.37 | 9 5 | 2.29 | 5 6 | 1.33 |
| Wigan | 52½ | 6 0 | 1.46 | 9 8 | 2.35 | 5 8 | 1.37 |
| Southport | 68½ | 7 0 | 1.70 | 10 6 | 2.55 | 6 6 | 1.58 |
| Liverpool | 70 | 7 5 | 1.80 | 10 2 | 2.47 | 5 10 | 1.41 |

a For 5-ton lots. b For 6-ton lots. c In company's trucks. d In owner's trucks.

3. Before giving examples of rates on lumber it must be stated that the word "lumber" is not used in this country in connection with timber. The following definition of timber is therefore quoted from the general railway classification of goods:

TIMBER.

(1) The term "timber" embraces all descriptions of wood in an unmanufactured or roughly hewn or roughly sawn state; but (except when otherwise specifically stated) not any wood shaped or prepared or partially prepared or any description of wood separately specified in the classification.

(2) For square timber the divisor of 144 is used.

(3) In the measurement of round timber, when carried at measurement weight, the divisor of 113 is applied, measurement being taken by string under bark (or by string over bark with a reasonable allowance for the bark), except when such timber is consigned at tape-over-bark rates or it is agreed that tape-over-bark rates shall apply.

(4) The right is reserved to require payment for the carriage of bark upon round timber charged on the 113 divisor in addition to the rates charged for such timber.

(5) When round timber is carried at tape-over-bark rates the divisor of 144 is applied, measurement being taken by tape over bark.

(6) Round timber: (*a*) Between stations on Scotch railways; (*b*) from stations on Scotch railways to stations in England and Wales; (*c*) from Northeastern Railway Company's stations charged at measurement weight, is carried at tape-over-bark measurement with the divisor of 144, the rates being exclusive of loading, for which service, when performed by the company, an additional charge is made.

(7) When debenture, octagonal, waney-edged, or other timber of defective angle on all four edges (the total of such wanes or defective angles being not less than one-fifth nor more than one-half of the circumference of the log) is measured by caliper, the 144 divisor is used, but an allowance is made of 22½ per cent. No allowance is made on logs having defective angles totaling less than one-fifth of the circumference.

When debenture, waney-edged, and defective angle timber is measured by tape the 144 divisor is used, but in such case the allowance as when measured by caliper is not made.

(8) Timber having wanes or defective angles totaling more than one-half of the circumference is measured and charged as "round timber."

(9) Baltic sleepers and sleeper blocks are charged at measurement weight on the following basis:[a] Sleepers 10 by 5 inches by 9 feet, rectangular, 16 creosoted and 17 not creosoted, to be taken as equal to 1 ton; other dimensions pro rata.

(10) Lath wood (not laths) is charged per square fathom, or 36 square feet, 9 hundredweight per foot in length.[a]

(11) When timber (other than round timber, creosoted telegraph, telephone, ricker, and scaffold poles, and except sleepers which are

[a] Not applicable to traffic between stations on Scotch railways.

already provided for by clause 9) chargeable at measurement weight is creosoted, an addition of 5 per cent is made to the weight for the creosote.

(12) All timber in pieces of or over 6 tons measurement to be charged 25 per cent over usual rates.

(13) The weights of the various descriptions of timber must be computed from the measurements upon the following basis:

*Forty cubic feet equal to 1 ton.*

| | | |
|---|---|---|
| Acacia. | Gumwood (Australian). | Oak. |
| Apple. | Hickory. | Padouk. |
| Ash. | Holly. | Pear. |
| Baywood. | Hornbeam. | Persimmon wood. |
| Beach. | Ironwood. | Purpleheart. |
| Blackbutt. | Jarrah. | Sabicu. |
| Boxwood. | Karri. | Serayah wood. |
| Ebony. | Lignum-vitæ. | Teak. |
| Greenheart. | Mahogany. | Other heavy timber. |

*Fifty cubic feet equal to 1 ton.*

| | | |
|---|---|---|
| Alder. | Hemlock. | Rosewood. |
| Birch. | Kauri pine. | Satin walnut (American gumwood). |
| Camphor wood. | Lance wood. | |
| Cedar. | Larch. | Satinwood. |
| Cherry. | Maple. | Sequoia pine. |
| Chestnut wood (Spanish and horse). | Pine. | Spruce. |
| | Pitch pine. | Sycamore. |
| Elm [a] | Plane. | Walnut. |
| Fir. | Poplar. | Other light timber. |
| Hazel pine. | | |

(14) Except as provided in clause 6, the rates for round timber, unless otherwise noted, includes the ordinary service of loading from beneath the crane when the company perform that service, but are exclusive of haulage to the crane when the timber has been previously deposited at a distance therefrom. When the company do not perform the service of loading, a rebate is allowed.

(15) The rates for round timber do not include unloading.

(16) Round timber at measurement weight is charged at exceptional rates.

(17) When timber is consigned by measurement weight, the number of cubic feet must be declared by senders when consigning the timber. If, at request of senders, the company ascertain the measurement a separate charge is made for such service.

(18) For pieces of timber weighing less than 4 tons each in weight, which, on account of their length require more trucks than one for their conveyance, a minimum charge is made of 1 ton per truck for each truck used, whether carrying part of the load or used as a safety wagon only.

(19) Clauses 6, 14, 15, and 16, as above, apply also to pitwood consigned direct to a mine, measurement weight, which is charged at tape over bark measurement, 144 divisor.

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[a] When elm is measured by string under bark (or by string over bark with the allowance for bark) with the 113 divisor, 40 cubic feet are taken as equal to 1 ton.

The following are charged at exceptional rates noted for deals, battens, or boards, or, in the absence of exceptional rates, at Class C rates, in consignments of 2 tons and upward:

| Kinds of timber. | Rate. |
|---|---|
| Aspen or poplar squares | Machine weight. |
| Deals, battens and boards unprepared (not exceeding 4 inches in thickness) of fir and pine other than Carolina, Pensacola, or other pitch-pine deals, battens, and boards. | 66 cubic feet to the ton. |
| Carolina, Pensacola, or other pitch-pine deals, battens, and boards, unprepared (not exceeding 4 inches in thickness). | 55 cubic feet to the ton. |
| Lathwood (not laths) | Measurement weight. |
| Paving-blocks wood | Do. |
| Pieces of roughly sawn wood, in short lengths, tied in bundles (for making packing boxes) | Do. |
| Posts, cut square with butt ends for fencing | Do. |
| Posts and rails, fir, cut square for fencing (not exceeding 4 inches in thickness) | 66 cubic feet to the ton. |
| Posts and rails, cut square for fencing, including mortised posts and scarped rails, but excluding posts with butt ends, no allowance in measurements to be made for mortising or scarping, or other inequality. | Measurement weight. |
| Sequoia-pine deals (not exceeding 4 inches in thickness) | 66 cubic feet to the ton. |
| Sequoia-pine deals (exceeding 4 inches in thickness) | 50 cubic feet to the ton. |
| Sleepers wood, including creosoted (*See* clause 9.) | Measurement weight. |
| Stavewood (not staves) | Machine weight. |
| Teak blocks | |

Any of the following sawn into planks or sawn or hewn into square or waney-edged logs, as defined in clause 7, are charged by measurement weight: Alder, ash, beech, birch, chestnut, elm, fir, hemlock, hornbeam, larch, oak, pine, pitch pine, plane, poplar, sequoia, spruce, sycamore, teak.

The following are charged 10 per cent over the exceptional rates noted for deals, battens, and boards, but not to exceed the Class C rates, in consignments of 2 tons and upward:

| Kind of timber. | Rate. |
|---|---|
| Flooring blocks (not parquetry nor inlaid) | Machine weight. |
| Boards, flooring (prepared), and other planed or prepared boards (not parquetry nor inlaid). | Measurement weight. |
| Boards, tongued and grooved (as planed or prepared boards) | Do. |

The following are charged 20 per cent over the exceptional rates noted for deals, battens, and boards, or, in the absence of exceptional rates, at 20 per cent over the Class C rates in consignments of 2 tons and upward:

| Kind of timber. | Rate. |
|---|---|
| Pitwood, exceeding 9 feet in length, consigned direct to a mine[a] | Measurement weight. |
| Telegraph, telephone, ricker, and scaffold poles | Do. |

[a] Applicable only to stations covered by clause 6.

The following are charged 10 per cent less than the exceptional rates noted for deals, battens, and boards, or, in the absence of exceptional rates, at 10 per cent less than the Class C rates, in consignments of 2 tons and upward: Pitwood, consigned direct to a mine, machine weight.

The following are charged at Class C rates, in square or waney-edged logs as defined in clause 7, above, or sawn into planks or boards:

| Kind of timber. | Rate. |
|---|---|
| Baywood, camphor wood, cedar, cherry, gumwood (American), gumwood (Australian), hickory, jarrah, karri, lancewood, mahogany, maple, padouk, persimmon wood, sabicu, satin walnut, serayah wood, walnut. | Measurement weight. |
| Blackbutt, sawn into planks | Machine weight. |
| Cocus wood, ebony, and rosewood, in logs or sawn into planks | Do. |
| Satinwood (in logs or sawn into planks), silkwood, telegraph-pole cross pieces | Do. |
| Zapateria wood | Do. |

The following are charged at class 1 rates in less lots than 2 tons:

| Kind of timber. | Rate. |
|---|---|
| Flooring blocks (not parquetry nor inlaid) | Machine weight. |
| Pieces of roughly sawn wood, in short lengths, tied in bundles (for making packing boxes). | Do. |
| Telegraph pole crosspieces | Do. |
| Boards, flooring (prepared), and other planed or prepared boards (not parquetry nor inlaid). | Measurement weight. |

The Midland Railway Company's rates on timber, under Class C and the exceptional rate for deals, battens, and boards, are as follows:

| Between Bradford and— | Distance. | Class C (ordinary). | | Deals, battens, and boards. | | Measurement weight of— |
|---|---|---|---|---|---|---|
| | *Miles.* | *s. d.* | | *s. d.* | | |
| London | 191 | 19 3 | $4.68 | 14 10 | $3.61 | 5 tons. |
| Hull | 61 | 8 9 | 2.13 | None. | None. | (a) |
| Grimsby | 81 | 8 9 | 2.13 | None. | None. | (b) |
| West Hartlepool | 78¾ | 12 3 | 2.98 | 8 9 | 2.13 | 2 tons. |
| Liverpool | 70 | 10 2 | 2.47 | 8 9 | 2.13 | Do. |
| Middlesboro | 69¾ | 10 6 | 2.55 | 8 9 | 2.13 | Do. |
| Newcastle | 104 | 14 10 | 3.61 | 9 2 | 2.23 | Do. |
| Goole | | 8 9 | 2.13 | None. | None. | (a) |
| Barrow | 84½ | 11 4 | 2.75 | None. | None. | (b) |
| Lynn Docks | 167½ | 18 2 | 4.42 | 12 1 | 2.94 | 2 tons. |

a Specials for alder, beech, and birch, round or partially squared, machine weight 2 tons, 8s. 4d. ($2.03).
b Measurement weight 2 tons, 11s. 3d. ($2.74).

The Great Northern Railway Company's rates on timber under Class C, and exceptional rates for round timber, are as follows:

| Between Bradford and— | Distance. | Class C. | | Exceptional rates round timber inclusive of loading. | | | |
|---|---|---|---|---|---|---|---|
| | | | | String under bark, 113 divisor. | | Tape over bark, 144 divisor. | |
| | *Miles.* | *s. d.* | | *s. d.* | | *s. d.* | |
| Leeds | 9 | 3 6 | $0.85 | 5 1 | $1.23 | 6 0 | $1.46 |
| Halifax | 9½ | 3 6 | .85 | 5 1 | 1.23 | 6 0 | 1.46 |
| Batley | 9½ | 3 8 | .89 | | | | |
| Keighley | 14 | 3 6 | .85 | | | | |
| Wakefield | 16¾ | 5 0 | 1.21 | 6 4 | 1.54 | 7 0 | 1.70 |
| Doncaster | 35¾ | 8 0 | 1.94 | 10 0 | 2.43 | 10 5 | 2.53 |
| Lincoln | 72 | 11 4 | 2.75 | | | | |
| Grantham | 86½ | 13 1 | 3.18 | 16 5 | 3.99 | 16 5 | 3.99 |
| Spalding | 110¾ | 15 9 | 3.83 | | | | |
| Derby | 113¾ | 12 3 | 2.98 | 15 10 | 3.85 | 16 10 | 4.09 |

The Lancashire and Yorkshire Railway Company's rates for timber under Class C are as follows:

| Between Bradford and— | Distance. | Class C. | | | Exceptional rate, round timber, exclusive of loading and unloading. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | String under bark, 113 divisor. | | | Tape over bark, 144 divisor. | | |
| | *Miles.* | *s.* | *d.* | | *s.* | *d.* | | *s.* | *d.* | |
| Low Moor | 3 | 3 | 1 | $0.75 | | | | | | |
| Wakefield | 17½ | 5 | 0 | 1.21 | | | | | | |
| Pontefract | 26 | 6 | 0 | 1.46 | | | | | | |
| Burnley | 29½ | 7 | 1 | 1.72 | | | | | | |
| Manchester | 40 | 8 | 1 | 1.96 | | | | | | |
| Blackburn | 40¾ | 8 | 3 | 2.00 | | | | | | |
| Clitheroe | 50½ | 9 | 2 | 2.23 | | | | | | |
| Preston | 52 | 9 | 7 | 2.33 | | | | | | |
| Blackpool | 70 | 11 | 3 | 2.73 | | | | | | |
| Liverpool | 70 | 10 | 2 | 2.47 | 12 | 0 | $2.92 | 12 | 0 | $2.92 |

FERTILIZERS.

4. This term is not in general use in this country, but is covered by the classification "manure." Under the general railway classification there are three classes of manure, namely, Class A: Street, stable, and farmyard manure in bulk. Class B: Other than street, stable, and farmyard manure in bulk. Class C: Packed manure.

The following articles, when packed and sent direct for manure are classified as packed manure in Class C: Artificial manures; blood for manure; bones, common, for manure; guano; lime, superphosphate of, packed; nitrate of soda; sulphate of ammonia for manure or when sent to chemical works.

The Midland Railway Company's rates on manures in the various classes are as follows:

| Between Bradford and— | Distance. | Per ton. | | | | | | | | Class C: Exceptional rates, packed manure, station to station. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Class A. | | | Class B. | | | Class C. | | | 2-ton lots. | | | 4-ton lots. | |
| | *Miles.* | *s.* | *d.* | | *s.* | *d.* | | *s.* | *d.* | | *s.* | *d.* | | *s.* | *d.* | |
| Barnsley | 36½ | | | | 3 | 8 | $0.89 | 6 | 2 | $1.50 | 4 | 3 | $1.03 | 3 | 6 | $0.85 |
| Swinton | 41¾ | 3 | 1 | $0.75 | 4 | 7 | 1.11 | 7 | 4 | 1.78 | 6 | 1 | 1.48 | | | |
| Sheffield | 51½ | 3 | 6 | .85 | 5 | 3 | 1.28 | 8 | 8 | 2.10 | | | | 6 | 0 | 1.46 |
| Worksop | 73¼ | | | | 5 | 8 | 1.38 | 10 | 6 | 2.55 | | | | 6 | 9 | 1.64 |
| Moira | 105 | | | | 8 | 5 | 2.05 | 14 | 0 | 3.40 | | | | 11 | 8 | 2.84 |
| Lincoln | 109½ | | | | 7 | 5 | 1.80 | 11 | 4 | 2.76 | 8 | 10 | 2.15 | 7 | 8 | 1.86 |
| Longstow | 155½ | | | | 10 | 0 | 2.43 | 17 | 7 | 4.28 | | | | 11 | 4 | 2.76 |
| Bristol | 216¼ | | | | 13 | 9 | 3.34 | 21 | 0 | 5.11 | | | | 18 | 4 | 4.46 |

The Great Northern Railway Company's rates on manure in the various classes are as follows:

| Between Bradford and— | Distance. | Per ton. Class A. | | Class B. | | Class C. | | Class C: Exceptional rates, packed manure, station to station. 4-ton lots. | | 2-ton lots. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Miles.* | *s. d.* | | *s. d.* | | *s. d.* | | *s. d.* | | *s. d.* | |
| Halifax | 9½ | 1 2½ | $0.28½ | 1 11 | $0.46 | 3 6 | $0.85 | | | | |
| Dewsbury | 11¾ | 1 8½ | .40½ | 2 4 | .56 | 3 8 | .89 | | | | |
| Keighley | 14 | 1 4½ | .33½ | 1 11½ | .47 | 3 6 | .85 | | | | |
| Stanley | 15 | 2 3½ | .55½ | 3 1 | .75 | 4 11 | 1.19 | | | | |
| Wakefield | 16½ | 1 11½ | .47 | 3 0½ | .74 | 5 0 | 1.21 | | | | |
| Doncaster | 35½ | 3 7 | .87 | 4 11 | 1.19 | 8 0 | 1.94 | | | | |
| Nottingham | 95 | 6 2 | 1.50 | 7 10 | 1.90 | 12 3 | 2.98 | 8 1 | $1.96 | 9 4 | $2.27 |
| Codnor Park | 107½ | 5 7 | 1.35 | 7 3 | 1.76 | 11 4 | 2.75 | *a* 2 1<br>*b* 1 10 | *a* .50<br>*b* .44 | | |
| Ramsey | 128 | 9 1 | 2.21 | 10 0 | 2.43 | 16 7 | 4.03 | 12 4 | 3.00 | 14 2 | 3.44 |
| London | 191 | | | 13 1 | 3.18 | 19 3 | 4.68 | *c* 14 10 | *c* 3.60 | | |

*a* In company's wagons. *b* In owner's wagons. *c* In 5-ton lots.

The Lancashire and Yorkshire Railway Company's rates on manure in the various classes are as follows:

| Between Bradford and— | Distance. | Per ton. Class A. | | Class B. | | Class C. | | Class C: Exceptional rates, packed manure, station to station. 2-ton lots. | | 4-ton lots. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Miles.* | *s. d.* | | *s. d.* | | *s. d.* | | *s. d.* | | *s. d.* | |
| Halifax | 8½ | | | 1 11 | $0.46 | 1 8 | *a* $0.40 | | | | |
| Netherton | 15¾ | | | | | 5 0 | 1.21 | 4 2 | $1.01 | 3 4 | $0.81 |
| Mathley | " 20½ | 2 5 | $0.58 | 3 2 | .77 | 4 8 | 1.13 | (*b*) | (*b*) | (*b*) | (*b*) |
| Clayton West | 24 | | | *c* 3 8 | *c*. 89 | 6 2 | 1.50 | 5 0 | 1.21 | 4 2 | 1.01 |
| Pontefract | 26 | | | 3 10 | .93 | 6 0 | 1.46 | (*d*) | (*d*) | (*d*) | (*d*) |
| Burnley | 29½ | | | *c* 3 11 | *c*. 95 | 7 1 | 1.72 | | | | |
| Hensall | 34½ | 3 2½ | .78 | 4 6 | 1.09 | 7 5 | 1.80 | (*e*) | (*e*) | (*e*) | (*e*) |
| Manchester | 40 | | | 4 10 | 1.17 | 8 1 | 1.96 | 7 2 | 1.47 | 6 3 | 1.52 |
| Ashton | 44 | | | 4 4 | 1.05 | 7 5 | 1.80 | 7 10 | 1.90 | 7 0 | 1.70 |
| Liverpool | 70 | | | 7 5 | 1.80 | 10 2 | 2.47 | 9 7<br>*f* 12 11 | 2.33<br>*f* 3.14 | 8 4 | 2.02 |

*a* In 4-ton lots.
*b* Class A, 1s. 11d. (46 cents).
*c* In company's wagons.
*d* Class A, in owner's wagons, 2s. 7d. (62 cents); Class A, in company's wagons, 3s. (73 cents).
*e* Class A, 3s. (73 cents).
*f* In less than 2-ton lots.

GRAIN.

5. The Midland Railway Company's rates on grain are as follows:

| Between Bradford and— | Distance. | Class C, per ton. | | Exceptional rate (4-ton lots). | |
|---|---|---|---|---|---|
| | *Miles.* | *s. d.* | | *s. d.* | |
| Sheffield | 51½ | 8 8 | $2.11 | *a* 7 1 | *a* $1.72 |
| Derby | 85¾ | 12 3 | 2.98 | 9 8 | 2.35 |
| Nottingham | 90¾ | 12 3 | 2.98 | 10 1 | 2.45 |
| Melton Mowbray | 109 | 14 0 | 3.40 | 11 2 | 2.72 |
| Lincoln | 109¼ | 11 4 | 2.76 | 9 2 | 2.23 |
| Ullesthorpe | 122 | 15 8 | 3.81 | 13 5 | 3.26 |
| Stamford | 134¼ | 16 0 | 3.89 | 12 2 | 2.96 |
| Wellingbro | 143¾ | 16 11 | 4.11 | 15 2 | 3.69 |
| Longstow | 155½ | 17 7 | 4.28 | 15 1 | 3.67 |
| Cambridge | 184½ | 20 1 | 4.89 | 16 2 | 3.93 |

*a* In 5-ton lots.

The Great Northern Railway Company's rates on grain are as follows:

| Between Bradford and— | Distance. | Class C (per ton). | Exceptional rate. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2-ton lots. | | 4-ton lots. | | 5-ton lots and upward. | |
| | *Miles.* | *s. d.* | *s. d.* | | *s. d.* | | *s. d.* | |
| Leeds | 9 | 3 6 | 2 6 | [a] $0.60 | | | | |
| | | $0.85 | [a] 5 0 | [a] 1.21 | | | | |
| | | | [b] 5 3 | [b] 1.27 | | | | |
| Keighley | 14 | 3 6 | .85 | | 3 0 | $0.73 | | |
| Wakefield | 16¾ | 5 0 | 1.21 | 4 4 1.05 | 4 2 | 1.01 | | |
| Doncaster | 35¾ | 8 0 | 1.94 | | 6 3 | 1.52 | | |
| Retford | 52¼ | 9 7 | 2.33 | | 7 6 | 1.82 | | |
| Lincoln | 72 | 11 4 | 2.75 | 10 6 2.55 | 9 2 | 2.23 | | |
| Boston | 104 | 14 10 | 3.60 | 13 8 3.32 | | | 11 3 | $2.73 |
| Spalding | 110 | 15 9 | 3.83 | | | | 11 8 | 2.83 |
| Lynn | 137 | 18 2 | 4.42 | | 13 4 | 3.24 | | |
| London | 191 | 19 3 | 4.68 | 17 6 4.25 | | | 14 2 | 3.44 |

[a] Collected and delivered. [b] Less than 2 tons collected and delivered.

The Lancashire and Yorkshire Railway Company's rates on grain are as follows:

| Between Bradford and— | Distance. | Class C (per ton). | Exceptional rate. | | | |
|---|---|---|---|---|---|---|
| | | | 2-ton lots. | | 4-ton lots. | |
| | *Miles.* | *s. d.* | *s. d.* | | *s. d.* | |
| Halifax | 8¼ | 3 6 | $0.85 | | 3 4 | $0.81 |
| Elland | 11 | 4 3 | 1.03 | | 3 4 | 0.81 |
| Huddersfield | 12¾ | 4 6 | 1.09 | 3 9 $0.91 | | |
| Hebden Bridge | 17 | 5 2 | 1.25 | | 4 3 | 1.03 |
| Todmorden | 21½ | 5 10 | 1.41 | 5 3 1.27 | | |
| Norton | 34¾ | 7 6 | 1.82 | | 6 9 | 1.64 |
| Manchester | 40 | 8 1 | 1.96 | | 7 6 | 1.82 |
| Ashton | 44½ | 7 5 | 1.80 | | | |
| Kirkby | 64½ | 10 10 | 2.63 | | 8 9 | 2.12 |
| Liverpool | 70 | 10 2 | 2.47 | [a] 12 11 [a] 3.14 | 9 10 | 2.39 |

[a] Less than 2 lots.

## *Question III.—Export rates.*

The following are tabulated statements of the rates on various commodities charged by the three above-mentioned railroads, showing distances, ordinary rate, special rate, and finally the export rate:

*Statement of rates on the Midland Railway Company.*

WOOL.

| From Bradford to— | Distance. | Ordinary rate, class 2. | Special rate, per ton. | Export rate. |
|---|---|---|---|---|
| | *Miles.* | *s. d.* | *s. d.* | *s. d.* |
| Manchester | 37 | 14 8 $3.57 | | 11 8 $2.84 |
| Hull | 61 | 15 10 3.85 | 15 0 $3.65 | |
| Middlesboro | 69¾ | 20 10 5.07 | 15 0 3.65 | |
| Liverpool | 70 | 16 9 4.07 | 15 10 3.85 | |
| Newcastle | 104 | 27 1 6.59 | 22 6 5.47 | |
| London | 191 | 39 4 9.57 | 32 6 7.91 | 30 0 7.30 |
| Southampton | 286 | 48 1 11.70 | | 30 0 7.30 |

*Statement of rates on the Midland Railway Company*—Continued.

WOOLEN, WORSTED, AND STUFF GOODS.

| From Bradford to— | Distance. | Ordinary rate, class 3. | | Special rate (per ton). | | Export rate. | |
|---|---|---|---|---|---|---|---|
| | *Miles.* | *s. d.* | | *s. d.* | | *s. d.* | |
| Manchester | 37 | 18 10 | $4.58 | 18 10 | $4.58 | 12 2 | $2.96 |
| Hull | 61 | 19 2 | 4.66 | 15 0 | 3.65 | 15 0 | 3.65 |
| Middlesborough | 69¾ | 24 2 | 5.88 | ..... | ..... | 15 0 | 3.65 |
| Liverpool | 70 | 20 6 | 4.99 | 18 4 | 4.46 | 16 8 | 4.05 |
| Newcastle | 104 | 31 3 | 7.60 | ..... | ..... | 15 0 | 3.65 |
| London | 191 | 45 6 | 11.07 | 43 4 | 10.54 | 32 6 | 7.91 |
| Bristol | 200 | 46 10 | 11.39 | 43 4 | 10.54 | ..... | ..... |
| Southampton | 286 | 59 9 | 14.54 | ..... | ..... | 32 6 | 7.91 |

COTTON AND LINEN GOODS.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Manchester | 37 | 17 4 | $4.22 | 16 2 | $3.93 | ..... | ..... |
| Hull | 61 | 19 2 | 4.66 | 15 9 | 3.83 | 15 0 | $3.65 |
| Middlesborough | 69¾ | 24 2 | 5.88 | ..... | ..... | ..... | ..... |
| Liverpool | 70 | 20 6 | 4.99 | ..... | ..... | ..... | ..... |
| Newcastle | 104 | 31 3 | 7.60 | ..... | ..... | ..... | ..... |
| London | 191 | 45 6 | 11.07 | 43 4 | 10.54 | 32 6 | 7.91 |
| Southampton | 286 | 59 9 | 14.54 | ..... | ..... | 32 6 | 7.91 |

MACHINERY.

| From Bradford to— | Distance. | Ordinary rate, class 2, (packed in boxes). | | Ordinary rate, class 3 (not packed in boxes). | | Special rate. | | Export rate. | |
|---|---|---|---|---|---|---|---|---|---|
| | *Miles.* | *s. d.* | | *s. d.* | | *s. d.* | | *s. d.* | |
| Manchester docks | 37 | 14 8 | $3.57 | 17 4 | $4.22 | ..... | ..... | 13 1 | $3.18 |
| Hull | 61 | 15 10 | 3.85 | ..... | ..... | 13 9 | $3.34 | ..... | ..... |
| Middlesborough | 69¾ | 20 10 | 5.07 | 24 2 | 5.88 | 13 9<br>14 5 | 3.34<br>3.51 | ..... | ..... |
| Liverpool | 70 | 20 5 | 4.97 | ..... | ..... | 17 6 | 4.26 | ..... | ..... |
| Newcastle | 104 | 27 1 | 6.59 | 31 3 | 7.60 | 23 4 | 5.68 | 16 7 | 4.03 |
| London | 191 | 39 4 | 9.57 | 45 6 | 11.07 | 30 0 | 7.30 | ..... | ..... |

## The Great Northern Railway Company's rates are as follows:

[Between Bradford and Boston, 104¼ miles.]

| Article. | Class. | Per ton. Ordinary rate. | | Exceptional rate. | | Export rate. | |
|---|---|---|---|---|---|---|---|
| | | *s. d.* | | *s. d.* | | *s. d.* | |
| Wool | 2 | 28 0 | $6.80 | 26 8 | $6.48 | 15 0 | $3.65 |
| Yarns | 3 | 32 3 | 7.84 | 15 9 | 3.83 | 15 0 | 3.65 |
| Machinery: | | | | | | | |
| In cases | 2 | 28 0 | 6.80 | ..... | ..... | [a]13 9<br>[b]14 5 | a 3.34<br>b 3.50 |
| Not in cases | 3 | 32 3 | 7.84 | ..... | ..... | [a]13 9<br>[b]19 2 | a 3.34<br>b 4.66 |
| Flocks | 2 | 28 0 | 6.80 | ..... | ..... | 15 10 | 3.85 |

[Between Bradford and London, 191 miles.]

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Textile fabrics (cotton, linen, wool, silk, etc.) in boxes or cases | 3 | 45 6 | $11.07 | 43 4 | $10.54 | 32 6 | $7.91 |
| Yarns (cotton, linen, wool) | 3 | 45 6 | 11.07 | ..... | ..... | 32 6 | 7.91 |
| Hats, felt (in boxes or cases) | 4 | 57 3 | 13.92 | 50 0 | 12.16 | 45 0 | 10.94 |
| Wire mattresses | 3 | 45 6 | 11.07 | ..... | ..... | 32 6 | 7.91 |
| Carpeting | 3 | 45 6 | 11.07 | ..... | ..... | 32 6 | 7.91 |
| Do | 4 | 57 3 | 13.92 | ..... | ..... | 32 6 | 7.91 |

[a] At owner's risk.

[b] At company's risk.

The Lancashire and Yorkshire Railway Company's rates are as follows:

[Between Bradford and Hull.]

| Article. | Class. | Per ton. Ordinary rate. | | | Exceptional rate. | | | Export rate. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | s. | d. | | s. | d. | | s. | d. | |
| Buckets | 2 | 15 | 10 | $3.85 | | | | 14 | 2 | $3.44 |
| Cotton and linen goods | 3 | 19 | 2 | 4.66 | 15 | 9 | $3.83 | 15 | 0 | 3.65 |
| Iron and steel | 3 | 19 | 2 | 4.66 | | | | a7 | 6 | a 1.82 |
| Textile fabrics | 3 | 19 | 2 | 4.66 | 15 | 9 | 3.83 | 15 | 0 | 3.65 |
| Yarns | 3 | 19 | 2 | 4.66 | | | | 15 | 0 | 3.65 |

[Between Bradford and Liverpool.]

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Woolen, worsted, and stuff goods | 3 | 20 | 6 | $4.98 | | | | 16 | 8 | $4.05 |

[Between Bradford and Manchester.]

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Woolen, worsted, and stuff goods | 3 | 18 | 10 | $4.58 | 13 | 8 | $3.32 | 12 | 2 | $2.96 |
| Yarns | 2 | 14 | 7 | 3.54 | 13 | 8 | 3.32 | 12 | 2 | 2.96 |

[Between Bradford and London, 198 miles.]

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Caps, cloth (in cases or boxes) | 4 | 57 | 3 | $13.92 | 50 | 0 | $12.16 | 45 | 0 | $10.94 |
| Carpeting | 3 | 45 | 6 | 11.06 | | | | 32 | 6 | 7.91 |
| Do | 4 | 57 | 3 | 13.92 | | | | 32 | 6 | 7.91 |
| Cotton and linen goods | 3 | 45 | 6 | 11.06 | 43 | 4 | 10.54 | 32 | 6 | 7.91 |
| Hats, felt, not soft (in cases or boxes) | 4 | 57 | 3 | 13.92 | 50 | 0 | 12.16 | 45 | 0 | 10.94 |
| Mattresses, wire, packed | 3 | 45 | 6 | 11.06 | | | | 32 | 6 | 7.91 |
| Textile fabrics | 3 | 45 | 6 | 11.06 | 43 | 4 | 10.54 | 32 | 6 | 7.91 |
| Yarns | 3 | 45 | 6 | 11.06 | | | | 32 | 6 | 7.91 |

a In 10-ton lots.

The following table of rates on the Lancashire and Yorkshire Railway Company to London are for conveyance partly by rail and partly by steamer, either via Goole, Hull, Grimsby, or Manchester. The last-named route will be approximately three times the distance of either of the others. It will be of interest to compare these rates with those in the preceding table which is for conveyance the whole distance by rail.

Taking a through-rail rate at 20s. ($4.86) the rate by rail and water is 16s. 3d. ($3.95), the relative proportions being—

| Via— | Rail. | | | Steamer. | | |
|---|---|---|---|---|---|---|
| | s. | d. | | s. | d. | |
| Goole | 6 | 3 | $1.52 | 10 | 0 | $2.43 |
| Hull | 7 | 6 | 1.82 | 8 | 9 | 2.12 |
| Grimsby | 8 | 4 | 2.02 | 7 | 11 | 1.92 |
| Manchester docks | 7 | 1 | 1.72 | 9 | 2 | 2.23 |

[Between Bradford and London.]

| Article. | Class. | Per ton. Ordinary rate. | | Exceptional rate. | | Export rate. | |
|---|---|---|---|---|---|---|---|
| | | s. d. | | s. d. | | s. d. | |
| Caps, cloth (in cases or boxes) | 4 | ..... | ..... | 41 8 | $10.13 | 36 8 | $8.91 |
| Carpeting | 3 | 37 1 | $9.01 | 31 3 | 7.59 | 27 6 | 6.68 |
| Do | 4 | 49 2 | 11.96 | ..... | ..... | 27 6 | 6.68 |
| Cotton and linen goods | 3 | 37 1 | 9.01 | 35 0 | 8.51 | 27 6 | 6.68 |
| Hats, felt, not soft (in cases or boxes) | 4 | 49 2 | 11.96 | 41 8 | 10.13 | 36 8 | 8.91 |
| Mattresses, wire, packed | 3 | 37 1 | 9.01 | ..... | ..... | 27 6 | 6.68 |
| Textile fabrics | 3 | 37 1 | 9.01 | 35 0 | 8.51 | 27 6 | 6.68 |

## *Question IV.—Highest grade classified freight.*

The highest grade of classified freight, according to the general railway classification is Class 5, and the following tables give this rate on the three railroads, the various points enumerated in question 1 being covered so far as possible in view of the difficulties stated in the introduction to this report:

THE MIDLAND RAILWAY COMPANY.

| Between Bradford and— | Distance. | Class 5, per ton (any quantity). | |
|---|---|---|---|
| | Miles. | s. d. | |
| Leeds | 10 | 15 9 | $3.83 |
| Manchester | 37 | 26 10 | 6.53 |
| Sheffield | 51½ | 28 0 | 6.81 |
| Liverpool | 70 | 30 0 | 7.30 |
| Derby | 85¾ | 39 9 | 9.67 |
| Nottingham | 90¼ | 39 10 | 9.69 |
| Birmingham | 128 | 47 0 | 11.43 |
| London | 191 | 77 6 | 18.86 |
| Bristol | 200 | 77 10 | 18.94 |
| Southampton | 234 | 82 6 | 20.07 |

THE GREAT NORTHERN RAILWAY COMPANY.

| | | | |
|---|---|---|---|
| Leeds | 9 | 15 9 | $3.83 |
| Halifax | 9½ | 15 9 | 3.83 |
| Keighley | 14 | 15 9 | 3.83 |
| Wakefield | 16½ | 19 4 | 4.70 |
| Lincoln | 71 | 38 11 | 9.46 |
| Boston | 103 | 40 3 | 9.79 |
| Hitchen | 159 | 59 3 | 14.41 |
| St. Albans | 179 | 62 1 | 15.10 |
| Hertford | 183 | 63 10 | 15.53 |
| London | 191 | 67 6 | 16.42 |

THE LANCASHIRE AND YORKSHIRE RAILWAY COMPANY.

| | | | |
|---|---|---|---|
| Low Moor | 3 | 10 6 | $2.55 |
| Halifax | 8½ | 15 10 | 3.85 |
| Wakefield | 17½ | 19 4 | 4.70 |
| Todmorden | 21½ | 21 3 | 5.16 |
| Rochdale | 30 | 23 9 | 5.77 |
| Oldham | 37 | 24 2 | 5.87 |
| Manchester | 40 | 26 10 | 6.52 |
| Manchester docks | 43 | 24 0 | 5.83 |
| Liverpool | 70 | 30 3 | 7.35 |
| London | 198 | 59 2 | 14.39 |

*Question V.—Typical classified products.*

Freight rates, so far as can be ascertained here, are not made for carloads but, as will have been seen from the preceding tables, are fixed principally for 2 or 4 ton loads. The following tables illustrate the varying rates charged by two of the railroads on different commodities for different distances in 2-ton lots and upward:

THE GREAT NORTHERN RAILWAY COMPANY.

[Between Bradford and Lincoln.]

| Article. | Class. | Per ton. Ordinary rate | | | Per ton. Exceptional rate. | | | Quantity. |
|---|---|---|---|---|---|---|---|---|
| | | s. | d. | | s. | d. | | Tons. |
| Grain and flour | C | 11 | 4 | $2.75 | 10 | 6 | $2.55 | 2 |
| | | | | | 9 | 2 | 2.23 | 4 |
| Oil and grease | 1 | 19 | 3 | 4.68 | 12 | 6 | 3.04 | 2 |
| Hay and straw [a] | 3 | 27 | 6 | 6.68 | 10 | 10 | 2.63 | 2½ |
| Manure, packed | C | 11 | 4 | 2.75 | 8 | 10 | 2.14 | 2 |
| | | | | | 7 | 8 | 1.86 | 4 |
| Stone | B | 7 | 5 | 1.80 | 6 | 8 | 1.62 | 4 |
| Vegetables [b] | 1 | 19 | 3 | 4.68 | 8 | 9 | 2.12 | 4 |
| Iron and steel [c] | C | 11 | 4 | 2.75 | 8 | 4 | 2.02 | 4 |

[a] Exclusive of labor, at owner's risk.
[b] Except cabbages, celery, cauliflowers, rhubarb, and green peas.
[c] At owner's risk.

[Between Bradford and London.]

| Article. | Class. | Per ton. Ordinary rate. | | | Per ton. Exceptional rate, station to station. | | | Quantity. |
|---|---|---|---|---|---|---|---|---|
| | | s. | d. | | s. | d. | | Tons. |
| Ale and porter (in casks) | 1 | 31 | 9 | $7.71 | 18 | 4 | $4.44 | 2 |
| | | | | | 17 | 6 | 4.25 | 10 |
| | | | | | [a] 24 | 2 | [a] 5.87 | |
| Alkali | C | 19 | 3 | 4.68 | 15 | 10 | 3.85 | 4 |
| Earthenware and bottles | 1 | 31 | 9 | 7.71 | 16 | 8 | 4.05 | 2 |
| Floor cloth | 3 | 45 | 6 | 11.06 | [a b] 25 | 0 | [a b] 6.07 | 2 |
| Grain | C | 19 | 3 | 4.68 | 17 | 6 | 4.25 | 2 |
| | | | | | 14 | 2 | 3.44 | 5 |
| Iron and steel | C | 19 | 3 | 4.68 | 15 | 0 | 3.65 | 2 |
| | | | | | [b c] 17 | 6 | [b c] 4.25 | 2 |
| Do | 1 | 31 | 9 | 7.71 | 18 | 4 | 4.46 | 2 |
| | | | | | [b] 14 | 2 | [b] 3.44 | 10 |
| Mineral oils | 2 | 39 | 4 | 9.54 | [d] 14 | 0 | [d] 3.40 | 8 |
| | | | | | [e] 14 | 0 | [e] 3.40 | 8 |
| Paper-making materials | C | 19 | 3 | 4.68 | 19 | 2 | 4.66 | 2 |
| Paper | 1 | 31 | 9 | 7.71 | 24 | 2 | 5.87 | 2 |
| Stone | B | 13 | 1 | 3.18 | [b] 11 | 8 | [b] 2.83 | 4 |
| | | | | | [c] 10 | 10 | [c] 2.63 | 5 |

[a] Carted and delivered.
[b] Owner's risk.
[c] Carted or delivered.
[d] For gas making, not giving off inflammable vapor at less than 73° F. direct to gas works, owner's tank wagons (tank wagons free both ways).
[e] For gas making, not giving off inflammable vapor at less than 150° F., owner's risk, exclusive loading and unloading.

## THE LANCASHIRE AND YORKSHIRE RAILWAY COMPANY.

[Bradford and Manchester, 37 miles.]

| Article. | Class. | Per ton. Ordinary rate. s. d. | Ordinary rate. | Exceptional rate, station to station. s. d. | Exceptional rate, station to station. | Quantity. |
|---|---|---|---|---|---|---|
| | | | | | | *Tons.* |
| Ale and porter (in casks) | 1 | 13 5 | $3.26 | a 11 8 | a $2.84 | 2 |
| Alkali | C | 8 1 | 1.97 | 6 8 | 1.62 | 4 |
| Grain | C | 8 1 | 1.97 | 7 6 | 1.82 | 4 |
| Iron and steel | C | 8 1 | 1.97 | 7 1<br>6 3 | 1.72<br>1.52 | 2<br>4 |
| Manure, packed | C | 8 1 | 1.97 | 7 2<br>6 3 | 1.74<br>1.52 | 2<br>4 |
| Soap | 1 | 13 5 | 3.26 | 9 2 | 2.23 | 2 |

[Bradford and Hull, 61 miles.]

| | | | | | | |
|---|---|---|---|---|---|---|
| Alkali | C | 8 9 | $2.13 | 8 4 | $2.03 | 4 |
| Cement | C | 8 9 | 2.13 | 7 6 | 1.82 | 4 |
| Clay, fire | A | ..... | ..... | 5 5 | 1.32 | 4 |
| Grain | C | 8 9 | 2.13 | 8 4 | 2.03 | 4 |
| Gas lime | A | ..... | ..... | 5 3 | 1.28 | 4 |
| Iron and steel | C | ..... | ..... | 8 4 | 2.03 | 4 |
| Manure, packed | C | 8 9 | 2.13 | 7 6 | 1.82 | 4 |

[Bradford and Liverpool, 70 miles.]

| | | | | | | |
|---|---|---|---|---|---|---|
| Ale and porter (in casks) | 1 | 15 10 | $3.85 | 12 6 | $3.04 | 2 |
| Alkali | C | 10 2 | 2.47 | 9 2 | 2.23 | 4 |
| Cement | C | 10 2 | 2.47 | 8 4 | 2.03 | 4 |
| Deals, battens, and boards | C | 10 2 | 2.47 | 8 9 | 2.13 | 5 |
| Grain | C | 10 2 | 2.47 | 9 10 | 2.39 | 4 |
| Iron and steel | C | 10 2 | 2.47 | b 9 2<br>b 7 11 | b 2.23<br>b 1.92 | 2<br>4 |
| Soap | 1 | 15 10 | 3.85 | 12 6<br>12 1 | 3.04<br>2.94 | 2<br>4 |

[Bradford and London, 191 miles.]

| | | s. d. | | s. d. | | *Tons.* |
|---|---|---|---|---|---|---|
| Ale and porter, in casks | 1 | 31 9 | $7.72 | 18 4 | $4.46 | 2 |
| Alkali | C | 19 3 | 4.68 | 15 10 | 3.85 | 4 |
| Cement | C | 19 3 | 4.68 | 14 10 | 3.61 | 4 |
| Deals, battens, and boards | C | 19 3 | 4.68 | 14 10 | 3.61 | 5 |
| Grain | C | 19 3 | 4.68 | 14 2<br>17 6 | 3.45<br>4.26 | 5<br>2 |
| Grindstones | C | 19 3 | 4.68 | 15 9 | 3.83 | 4 |
| Gunpowder in kegs | c 5 | ..... | ..... | 80 0<br>70 0 | 19.47<br>17.03 | 1<br>2 |
| Iron and steel | C | 19 3 | 4.68 | 15 0<br>a 17 6<br>a 15 0 | 3.65<br>a 4.26<br>a 3.65 | 2<br>2<br>10 |
| Stone sinks and troughs | C | 19 3 | 4.68 | b 12 3<br>b 11 4 | b 2.98<br>b 2.76 | 4<br>5 |
| Soap | 1 | 31 9 | 7.72 | 20 10 | 5.07 | 4 |

a Carted and delivered. b At owner's risk. c Plus 50 per cent.

## *Question VI.*

It is impossible to ascertain at Bradford, none of the railways having their head offices here, what matters are taken into consideration in the establishment or fixing of railroad freight rates. The preceding tables will have shown that some striking differences in rates on the same class of goods exist between points of equal or greater distance, showing, it is believed, that the rates to points reached by competing lines are uniform on all railroads, regardless of the fact that the mileage by the various lines is necessarily not identical. In such cases the rate is apparently fixed in part on the basis of the mileage by the shortest line. The exceptional rates are conditioned on the volume of traffic in any particular commodity.

The information which follows concerning the railway rates in Wales has been furnished by Lorin A. Lathrop, the consul at Cardiff, Wales.

TABLE No. 1.—*Coal rates on coal for shipment, whether for export, for coastwise, or for ship's own use.*

[(*e*) The rates in this table are all "Special."]

| (*a*) and (*b*) Termini and distances. | (*c*) Rates charged per ton of 2,240 pounds. | (*d*) Services covered by terminal charge. |
|---|---|---|
| From Albion Colliery to Cardiff Docks, via Taff Vale Ry., 15½ miles. | 8 4/8d. (17.43 cents); no terminal charge. | Railway locomotive takes car from coal mine sidings and delivers it on to the lines by the dock sides, whence it is hauled to the coal tip by hydraulic power belonging to dock. Dock owners charge 2d. (4.05 cents) for tipping; 2d. (4.05 cents) for wharfage; and ½d. (one-half cent) for weighing; total, 8.6 cents per ton. |
| From Garw Colliery to Swansea docks, via Great Western Ry., 35 miles. | 1s. 3½d. (31.41 cents); no terminal charge. | Dock charges, 3½d. (7.07 cents) for tipping; 2d. (4.05 cents) for wharfage; ½d. (one-half cent) for weighing; total, 11.62 cents per ton. |
| From Middle Duffryn Colliery to Southampton, via Great Western and London and Southwestern Rys., 135½ miles. | 5s. 6d. ($1.3381), of which 5s. ($1.2165) is transport and 6d. (12.16 cents) is terminal. | In this case the London and Southwestern Ry. owns the docks and charge is for haulage over dock lines to shipping wharves and use of wharves. |
| From Resolven Colliery to Brentford, near London, via Great Western (for shipment into vessels in Thames as cargo), 173½ miles. | 6s. 4d. ($1.5411); terminal charge not separable. | Use of the Great Western Ry. Co.'s wharves at Brentford. |
| From Resolven Colliery to Brentford, via Great Western (for shipment into steamers for their own consumption), 173½ miles. | 5s. 7d. ($1.3584); terminal charges not separable. | Do. |

TABLE NO. 2.—*Coal rates on coal for domestic consumption.*

[(*e*) The rates in this table are all "Special."]

| (*a*) and (*b*) Termini and distances. | (*c*) Rates charged per ton of 2,240 pounds. | (*d*) Services covered by terminal charge. |
|---|---|---|
| From Albion Colliery to Cardiff station, via of Taff Vale Ry., 14¼ miles. | 1s. 4⅓d. (34.33 cents), of which 1s. 1⅓d. (28.26 cents) is for transport and 3d. (6.07 cents) is for terminal. | Use of Taff Vale Ry. Co.'s station at Cardiff. |
| From Garw Colliery to Swansea, via Great Western Ry. (for industrial purposes), 35 miles. | 1s. 10d. (44.60 cents); no terminal charge. | Railway takes out of coal-mine siding and delivers to siding belonging to owner of works. |
| From Garw Colliery to Swansea, via Great Western Ry. (for carting from company's freight depot), 35 miles. | 2s. 1d. (50.67 cents), of which 1s. 10d. (44.60 cents) is for transport and 3d. (6.07 cents) for terminal. | Use of railway company's freight depot. |
| From Resolven Colliery to Tunbridge Wells, via Great Western and South Eastern and Chatham Rys., 212 miles. | 11s. 2d. ($2.7170); terminals not separable. | Includes use of company's depots, for which the maximum legal charge is 3d. (6.07 cents) per ton. |
| From Middle Duffryn Colliery to Paddington station, London, via Great Western Ry., 164 miles. | 7s. 2d. ($1.7434); terminals not separable. | Do. |

NOTES ON TABLES 1 AND 2.

(*b*) These tables give three maximum distance rates—one to Southampton and two to London. The low rate of $1.3381 from Middle Duffryn Colliery to Southampton—135¼ miles—is the result of water competition, but not that of river or canal. The real competitor of railways in an island like Britain, with many ports, is coastwise navigation. Detailed comparisons between railroad and coastwise charges would be superfluous, as American conditions are not the same; but these typical Southampton and London illustrations of the effect of coastwise competition may be of interest.

*Southampton.*—The rate from the Middle Duffryn Colliery to Cardiff by rail and the shipment costs at Cardiff amount to 33.35 cents, the coastwise freight to Southampton is 73 cents, and the total, $1.0635, is thus 27.46 cents under the railway rate.

Notwithstanding this considerable difference the railroad attracts its fair share of the traffic, owing to the better physical condition in which the coal reaches its destination. Coal tipped into vessel at Cardiff and discharged at Southampton is much more broken than after railway transport. Nevertheless, the rates compete, for large quantities go annually by land and by sea.

This greater breakage in water-borne coal will always be a vital factor in the United States. It is an accepted fact that in the United States the Pocahontas and Alabama coals are friable.

*London.*—The rate to Brentford, London, from Resolven Colliery—173¼ miles—for coal to be shipped as freight is $1.5411. This may be called almost a nominal rate, as such shipments are limited in number and small in quantity. Coal shipped to London for freight must be in small lots, as a ship carrying an appreciable amount would find it much cheaper to come to Cardiff.

The rate from Resolven for coal for ships' own consumption is $1.3584, and shipments are large, as liners and other steamers must coal in the Thames. To compare this rate with coastwise, 20 cents must be added for "barging" from Brentford to lower Thames.

*Charges by water.*—Rail from Resolven to Port Talbot, including shipment charges, 1s. 6d. (36.49 cents). Freight by "coasting coal barge" to Thames, 4s. (97.33 cents); total coastwise, 5s. 6d. ($1.3382). This compares with the rail charge of $1.5584.

(*e*) All the rates given in Tables 1 and 2 are called "Special," for the reason that they are below the minimum rates fixed by law. Coal is under Class A, the cheapest class in the schedules of merchandise rates.

In certain districts in which coal mining is the chief industry the acts of Parliament, which regulate rates, prescribe a lower maximum for coal than for other commodities in Class A. Thus, the act of Parliament which regulates the railway rates chargeable by the Taff Vale Railway (the railway rates and charges No. 18, order confirmation act, 1892) provides as follows:

*Maximum rate for conveyance per ton per mile.*

| | Rate per ton. | |
|---|---|---|
| | *d.* | *Cents.* |
| Coal | 0.875 | 1.76 |
| All other articles in Class A: | | |
| For the first 20 miles | .95 | 1.92 |
| For the next 30 miles or any part of such distance | .85 | 1.71 |

(*f*) Coal cars, capacity 10 to 12 tons, open, are constructed to specification agreed on by all railroads. The minimum load to receive ordinary rates is generally 4 tons.

The full train load is 50 cars (500 tons coal).

In South Wales, the railroad provides no cars. These are all owned by the coal-mine proprietors.

The rates charged and shown in tables 1 and 2 include the return of the empty car to the coal mine whence it was sent loaded.

There are no mixed train loads with coal intended for shipment. The lines which feed the docks exist primarily for coal, and they rush the coal trains to the dock sidings with quick dispatch.

The cars are so small, and the distances so short, that unmixed coal trains are usually made up even for coals intended for domestic use. The cars are uncoupled and left in the switches at their respective destinations. Coal cars are sometimes seen in slow freight mixed trains; but coal is never sent as fast freight. It would then become subject to the prohibitive rate for goods sent by "passenger"—the only equivalent of our "fast freight," and only used for such parcels as we should send by express.

TABLE NO. 3.—*Iron-ore rates.*

| (*a*) and (*b*). Termini and distances. | (*c*) Rates charged per ton of 2,240 pounds. | | | | | |
|---|---|---|---|---|---|---|
| | If shippers supply cars. | | | If railway supplies cars. | | |
| | *s.* | *d.* | | *s.* | *d.* | |
| From Cardiff docks to Blaenavon Iron Works, via Great Western Ry., or Rhymney and London and Northwestern railways, 32 miles | 1 | 9 | $0.4257 | 2 | 3 | $0.5473 |
| From Cardiff docks to Ebb Vale Iron Works, via Great Western Ry., 33 miles; or via Rhymney and London and Northwestern railways, 27 miles | 1 | 9 | .4257 | 2 | 3 | .5473 |
| From Cardiff docks to Westbury, Wiltshire, Iron Works, via Great Western Ry., 67 miles | 4 | 8 | 1.1355 | 5 | 5 | 1.3178 |
| From Ferndale Collieries to Walsall, via Taff Vale and London and Northwestern Rys., 122½ miles | 4 | 9 | 1.1557 | 5 | 6 | 1.3381 |
| From Ferndale colleries to Round Oak, via Taff Vale and Great Western Rys., 113¾ miles | 4 | 6 | 1.0949 | 5 | 3 | 1.2772 |
| From Trehafod Colliery to Round Oak, via Great Western Ry., 107¾ miles | 4 | 3 | 1.0340 | 5 | 0 | 1.2165 |
| From Cymmer Colliery (Porth) to Netherton, via Great Western Ry., 114¼ miles | 4 | 5 | 1.0746 | 5 | 2 | 1.2570 |
| From Cymmer Colliery (Porth) to Derby, via Taff Vale and Midland Rys., 160¼ miles | 6 | 8 | 1.6222 | 7 | 8 | 1.8654 |
| From Cardiff docks to Bilston, via London and Northwestern and Great Western Rys., 115 miles | 5 | 11 | 1.44 | 6 | 11 | 1.6830 |

NOTES ON TABLE 3.

(*d*) Terminable charges not separable. The only services rendered are taking cars from dock or coal-mine sidings and delivering to sidings of iron works. At neither end do sidings belong to railroad.
(*e*) Iron ore is in Class A, but all the above rates are special, being below maximum.
(*f*) The rates are the same under all conditions.
(*g*) Rates above quoted to Walsall, Round Oak, and other points in the Midlands are much below average, the ore being of a class only used in certain furnaces. It would remain on the dump at the coal mines if the railways did not make great concessions in freight charges. It is not "to encourage industry" but to get the business that charges are low, and they are at the maximum which the traffic will bear.

TABLE NO. 4.—*Stone rates.*

| (*a*) and (*b*) Termini and distances. | (*c*) Rates charged per ton of 2,240 pounds. | | |
|---|---|---|---|
| | *s.* | *d.* | *Cents.* |
| From Nelson quarry siding to Bedlinog station, via Taff Vale and Great Western Rys., 11½ miles | 2 | 0 | 48.66 |
| From Nelson quarry siding to Blaengwynfi station, via Taff Vale Ry. and connections, 22 miles | 3 | 0 | 73.00 |
| From Nelson quarry siding to Cymmer station, via Taff Vale and Great Western Rys., 24 miles | 3 | 3 | 79.04 |
| From Nelson quarry siding to Nine Mile Point station, via Taff Vale and London and Northwestern Ry., 16½ miles | 2 | 8 | 64.88 |
| From Nelson quarry siding to Bridgend station, via Taff Vale and Great Western Rys., 23¾ miles | 3 | 6¼ | 85.66 |
| From Nelson quarry siding to Brynmawr station, via Taff Vale and Great Western Rys., 26 miles | 3 | 1 | 75.02 |
| From Nelson quarry siding to Pontrhydfen station, via Taff Vale and connections, 28½ miles | 3 | 8 | 89.22 |
| From Nelson quarry siding to Maesteg station, via Taff Vale and Great Western Rys., 29½ miles | 3 | 10 | 93.27 |

NOTES ON TABLE 4.

(*d*) Terminal charges not separable.
(*e*) Terminal services are: Taking the cars from the traders' siding and the use of the company's freight depot at the receiving end.
(*f*) Stone, "wholly undressed" and straight from the quarry is in class A.
Roughly squared, for building, street pavements, curbs, etc., Class B.
All the rates in the table are "special" being under the minimum of the class rate.
(*g*) Rates are the same under all conditions; but if the trader supplies the cars, the rates are reduced from 4 to 8 cents per ton, according to distance, e. g., to Bedlinog, 11½ miles, 4 cents; to Brynmawr, 28 miles, 8 cents.
(*h*) Rates are low, but are all that this cheap commodity will bear, and it is not carried any distance. The apparent anomalies in above table (26 miles at 75 cents, 23¾ miles at 85 cents) are explained by the differing volume of the traffic.

TABLE NO. 5.—*Lumber rates from Cardiff docks.*

| (*a*) From Cardiff docks to destination. | Railways conveying traffic. | (*b*) Distance. | Total rate charged per ton. | |
|---|---|---|---|---|
| | | *Miles.* | *s. d.* | |
| Pontypridd | Taff Vale Ry | 13 | 3 6 | $0.8516 |
| Mountain Ash | do | 20¼ | 4 9 | 1.1557 |
| Penrhiwceiber | do | 19 | 4 7 | 1.1152 |
| Whitland | Great Western Ry | 89½ | 10 0 | 2.4332 |
| Haverfordwest | do | 106¼ | 10 6 | 2.5548 |
| Kidwelly | do | 64¼ | 8 9 | 2.1290 |
| Llandrindod Wells | London and Northwestern Ry | 82 | 9 2 | 2.2305 |
| Coalport | do | 117½ | 11 4 | 2.7576 |
| Sirhowy | do | 20 | 5 9 | 1.3989 |
| Newtown | Great Western Ry. and Cambrian Ry | 113 | 12 6 | 3.0414 |

NOTES ON TABLE 5.

(*c*) Terminal charges not separable. Terminal services are at sending end; taking the loaded cars off the dock lines; at receiving end; the use of the railroad company's depot.

(*d*) Lumber is in Class C, but the foregoing rates, being below legal maximum, are "special." The maximum in this class, say, from Cardiff to Penrhiwceiber, is 4s. 10d. ($1.18+); the lumber rate is 4s. 7d. ($1.12+). The maximum, say, to Coalport, 117 miles, is 15s. 7d. ($3.79+); the lumber rate is 11s. 4d. ($2.76+).

(*e*) Lumber is carried in open cars, belonging to the railway, and rates remain the same under all conditions, the minimum lot being 2 tons.

(*f*) These rates, always progressively lower as hauls get longer, are due to competition, to the large volume of trade (Cardiff being a great lumber port), and to the ease and cheapness with which the traffic can be handled.

*General.*—Pitwood is the local term for the stems of twenty-year old fir trees brought in immense quantities from Norway and France to Cardiff. It forms the coal mine timber and is carried at very low rates on the return journey of the coal owners' cars. It is in Class C, maximum rate 1.8d. (3.64 cents) per ton per mile. The actual rate, however, is, on the Taff Vale and Rhymney railways, 3 farthings (1.52 cents). To a coal mine 20 miles from Cardiff, the legal maximum would be 3s. (73 cents). The actual transport rate would be 1s. 3d. (30.40 cents.)

TABLE NO. 6.—*Fertilizer rates on packed imported manure.*

| (*a*) and (*b*) Termini and distances. | (*c*) Rates charged per ton of 2,240 pounds. | |
|---|---|---|
| | *s. d.* | |
| From Cardiff to Pontypridd station, via Taff Vale Ry., 13 miles | 2 11 | $0.7096 |
| From Cardiff to Mountain Ash station, via Taff Vale Ry., 20¼ miles | 4 2 | 1.0138 |
| From Cardiff to Penrhiwceiber station, via Taff Vale Ry., 19 miles | 4 2 | 1.0138 |
| From Cardiff to Whitland station, via Great Western Ry., 89½ miles | 8 4 | 2.0277 |
| From Cardiff to Haverfordwest station, via Great Western Ry., 106¼ miles | 9 7 | 2.3319 |
| From Cardiff to Kidwelly station, via Great Western Ry., 64¼ miles | 6 10 | 1.6627 |
| From Cardiff to Llandrindod Wells station, via London and Northwestern Ry., 82 miles | 10 0 | 2.4332 |
| From Cardiff to Coalport station, via London and Northwestern Ry., 117 miles | 11 8 | 2.8387 |
| From Cardiff to Sirhowy station, via London and Northwestern Ry., 20 miles | 4 9 | 1.1557 |
| From Cardiff to Newtown station, via Great Western and Cambrian Rys., 113 miles. | 12 6 | 3.0414 |

NOTES ON TABLE 6.

(*c*) Terminal charges not separable.

(*d*) Terminal services are use of dock lines and of sidings or of depot at receiving station. The trader loads at Cardiff and discharges at receiving station.

(*e*) Street, stable, or farmyard manure is in Class A; other manures in bulk, Class B; other manures, packed, Class C.

The rates above given are all "special," being below maximum, legally chargeable for its class. Competition of other railways accounts for this, but the reduction is not great on short hauls. For instance, the above quoted rate of $1.01, to Penrhiwceiber, is only 16 cents below maximum legal charge.

(*f*) The rate is the same under all conditions for lots of over four tons. Fertilizers are carried in closed cars belonging to the railway, and the charge for their use is included in the rate.

*General.*—Farmyard manure is not transported by rail in this district, and phosphates, etc., imported in bulk are treated and packed at entry port, hence no rate other than for "packed."

TABLE NO. 7.—*Grain rates from Cardiff docks.*

| (a) From Cardiff docks to destination. | Railways conveying the traffic. | (b) Distance. | (c) Terminal and transport charges. In lots of no less than 2 tons. | | In lots of no less than 4 tons. | | In lots of no less than 10 tons. | |
|---|---|---|---|---|---|---|---|---|
| | | *Miles.* | *s. d.* | | *s. d.* | | *s. d.* | |
| Pontypridd | Barry Ry | 16 | 3 4 | $0.8111 | 2 11 | $0.7096 | (a) | (a) |
| Sirhowy | London and Northwestern Ry. | 20 | 5 0 | 1.2165 | 4 2 | 1.0138 | (a) | (a) |
| Mountain Ash | Taff Vale Ry | 20¼ | 4 4 | 1.0544 | 4 2 | 1.0138 | (a) | (a) |
| Abergavenny | London and Northwestern and Great Western Rys. | 32 | 5 10 | 1.4192 | 4 7 | 1.1152 | 4 2 | $1.0138 |
| Bristol | Great Western Ry | 40 | 4 4 | 1.0544 | 3 6 | .8516 | 3 4 | .8111 |
| Kidwelly | do | 64¾ | 7 10 | 1.9059 | 6 10 | 1.6627 | (a) | (a) |
| Llandrindod Wells | London and Northwestern Ry. | 82 | 10 0 | 2.4332 | 9 2 | 2.235 | (a) | (a) |
| Whitland | Great Western Ry | 89½ | 9 7 | 2.3319 | 8 4 | 2.0277 | (a) | (a) |
| Haverfordwest | do | 106½ | 9 7 | 2.3319 | 8 9 | 2.1290 | b 7 10 | b 1.9059 |
| Newtown | Great Western and Cambrian Rys. | 113 | 13 1 | 3.1835 | 11 8 | 2.8387 | (a) | (a) |

a The 4-ton rate applies. b Five tons or over.

NOTES ON TABLE NO. 7.

(*c*) Terminal charges not separable.

(*d*) Terminal services at the despatching end comprise only the taking of the cars from the dock company's lines, and at the receiving end the use of the railroad depot. Loading and unloading are done by shipper.

(*e*) Grain is in Class C, and the 2-ton rates in the foregoing table are class rates. The 4 and 10 ton rates are special, being below maximum. The maximum Class C rate to, say, Penrhiwceiber, is 4s. 10d. ($1.18+). The grain rate is 4s. 7d. ($1.12+). The maximum Class C rate from Cardiff, say, to Coalport, 117½ miles is —

| | *s.* | *d.* | |
|---|---|---|---|
| First 20 miles, at 1.8d (3.65 cents) | 3 | 0 | $0.73 |
| Next 30 miles, at 1.5d (3.04 cents) | 3 | 9 | .91 |
| Next 50 miles, at 1.2d (2.43 cents) | 5 | 0 | 1.22 |
| Remaining 17½ miles, at 7d (1.419 cents) | 1 | 0 | .24 |
| Total for transport | 12 | 9 | 3.10+ |
| Maximum terminals, each end 1s (24 cents) | 2 | 0 | .49+ |
| Total | 14 | 9 | 3.59+ |
| Grain rate actually charged | 10 | 5 | 2.53 |
| Amount of grain rate below maximum | 4 | 4 | 1.06 |

(*f*) Grain is carried in closed cars belonging to the railways, and no concessions are made for full train loads: nor is there any such distinction known as slow and fast.

TABLE NO. 8.—*Special export rates, Great Western Railway, London to Cardiff, distance 152 miles.*

[(c) Rates per ton of 2,240 pounds.]

| Merchandise. | Total export rate, including terminals. | | For local consumption. | | | | Total rate. | |
|---|---|---|---|---|---|---|---|---|
| | | | Transport. | | Terminal. | | | |
| | s. d. | | s. d. | | s. d. | | s. d. | |
| Tea (class 3) | 25 0 | $6.08 | 27 0 | $6.57 | 12 4 | $3.00 | 39 4 | $9.57 |
| Linen (class 3) | 25 0 | 6.08 | 27 0 | 6.57 | 12 4 | 3.00 | 39 4 | 9.57 |
| Boats under 10 tons (class 3) | 37 6 | 9.12 | 27 0 | 6.57 | 12 4 | 3.00 | 39 4 | 9.57 |
| Passengers' luggage (class 4) | 26 3 | 6.39 | 33 9 | 8.22 | 14 6 | 3.52 | 48 3 | 11.74 |
| Cordials (class 5) | 50 0 | 12.16 | 40 9 | 9.92 | 17 0 | 4.13 | 57 9 | 14.05 |
| Silk goods (class 5) | 50 0 | 12.16 | 40 9 | 9.92 | 17 0 | 4.13 | 57 9 | 14.05 |

NOTES ON TABLE 8.

(c) Terminal charges on exports not separable.
(d) Terminal services rendered for the rates set out are as follows:

| | Class 3. | | Class 4. | | Class 5. | |
|---|---|---|---|---|---|---|
| | s. d. | | s. d. | | s. d. | |
| Use of depots | 3 0 | $0.73 | 3 0 | $0.73 | 3 0 | $0.73 |
| Loading and unloading | 2 0 | .4866 | 2 8 | .6488 | 3 4 | .8111 |
| Covering and uncovering | 4 | .0811 | 6 | .1216 | 8 | .1622 |
| Cartage, London | 5 0 | 1.2165 | 5 10 | 1.4182 | 6 8 | 1.6222 |
| Cartage, Cardiff | 2 0 | .4866 | 2 6 | .6082 | 3 4 | .8111 |
| Total | 12 4 | 3.00 | 14 6 | 3.52 | 17 0 | 4.13 |

(e) Export rates "special;" local rates, "class."
(f) Rates are for any weight over 3 hundredweight, whether train load or minimum, whether in open or closed cars. There is no division on British railways between slow and fast freights.

Open or closed cars are provided as merchandise requires, and tarpaulins are lashed over open cars where necessary. Charge for "covering" is included in "terminal charges" by law. (See "Railway rates and charges of United Kingdom," p. 4.)

Lumber, wood pulp, fertilizers, heavy steel goods, stone, etc., in open cars. Grain, flour, provisions, "damageable" manufactures, in closed cars.

*General.*—Cardiff export conditions are such that no comparative export rates for general merchandise exist except on the Great Western Railway Company, and these are almost exclusively from London alone. They apply also to coastwise shipments, and are given in part because the traffic is cheaper to handle, being in heavier single consignments; partly to attract London export shipments from usual channels.

Exports of steel, iron, and tinplates made in the vicinity of Cardiff get practically no advantage in rates over such manufactures used locally. For instance, the rate on pig iron from Blaenavon to Cardiff, 32 miles, is 3 s. (73 cents) whether for export or local use. Differential rates on coal are given in Table 9.

TABLE No. 9.—*Special export rates on coal.*

[Rates per ton of 2,240 pounds.]

| (*a*) and (*b*) Termini and distances. | (*c*) Transport and terminal charge. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total export rate.[a] | | | For domestic consumption. | | | | | | | | |
| | | | | Transport. | | | Terminal. | | | Total rate. | | |
| | *s.* | *d.* | | *s.* | *d.* | | *s.* | *d.* | | *s.* | *d.* | |
| From Albion Colliery to Cardiff, via Taff Vale Ry., 15½ miles. | 0 | $8\frac{13}{20}$ | $0.1742 | 1 | $1\frac{3}{8}$ | $0.2826 | 0 | 3 | $0.0607 | 1 | $4\frac{5}{16}$ | $0.3433 |
| From Garw Colliery to Swansea, via Great Western Ry., 35 miles. | 1 | $3\frac{1}{2}$ | .3140 | [b] 1 | 10 | [b] .4460 | | | | 1 | 10 | .4460 |
| | | | | [c] 1 | 10 | [c] .4460 | | 3 | .0607 | 2 | 1 | .5067 |
| From Resolven Colliery to Brentford, near London, via Great Western Ry., 173¾ miles. | 6 | 4 | 1.5411 | Not separable.. | | | | | | 7 | 4 | 1.7843 |
| From Middle Duffryn Colliery to Southampton, via Great Western and London and South Western Rys., 135¼ miles. | 5 | 6 | 1.3381 | Not separable.. | | | | | | 6 | 0 | 1.46 |

[a] Terminal charges on exports not separable, except Southampton, where above rate includes 12.16 cents at point of delivery.

[b] For industrial use in large quantities. No terminal charges. Cars switched to trader's sidings.

[c] For household use; carted from freight depot by trader.

NOTES ON TABLE No. 9.

See Tables 1 and 2, and note on these tables, pages 68 and 69.

*General.*—Of the 50,000,000 tons of coal mined in 1908 in the South Wales coal field, 25,000,000 tons went into foreign-going ships as freight, and 4,500,000 tons for steamers' own consumption, while 4,500,000 tons were put into coasting vessels. These 34,000,000 tons, loaded into cars at the "pit mouth," were hauled by rail from 15 to 30 miles, and tipped into ships by the most complete modern appliances. The railroads have no concern with these appliances. They do not own the railway sidings at the docks, nor those at the mines, nor even the cars in which the coal is carried. They are concerned in this coal field only with transport. Their work with the loaded car begins with switching it from the coal-mine siding. It ends with switching the loaded car onto the dock siding. They take back the empty cars, and their charge for this is included in the rates given in Tables 1, 2, and 9.

It will thus be seen that the natural differentiation of rates is not between "domestic" and "export," but between that intended for ships, whether sailing "foreign" or "coasting," whether for freight or the ships' own use, and that intended for domestic use. The rate for ships is lower than that for coal for domestic land use, primarily because the ship business is easier and cheaper to handle.

Nevertheless, the general law of commerce—that export rates shall be cheaper—operates, as for instance, in the case of shipments from Garw to Swansea—31+ cents for ships, 44+ cents for local manufacturers. It costs the railway little more to deliver to manufacturers' siding than to dock siding, yet the difference in rate is 13 cents per ton.

Coal has been locally sold for export within the past two years at $4 per ton while the large Cardiff consumer has been compelled to pay $4.86. Thus coal owners competing eagerly for export business, maintain local prices, and it follows that coal for home use will bear a heavier transport charge than that for export.

Railroads do not own coal mines, either directly or indirectly, though some coal mine proprietors own railway stock and may be railway directors; but no preferential rate results.

TABLE NO. 10.—*Ten illustrations of rates charged by different railways for different distances on the highest grade of classified freight, Class 5.*

| (a) and (b) Termini: From Cardiff to— | (c) Transport and terminal. | | | | | |
|---|---|---|---|---|---|---|
| | Total charge. | | For transport. | | For terminal. | |
| | s. d. | | s. d. | | s. d. | |
| Aberdare, via Taff Vale Ry., 24 miles | 21 6 | $5.23 | 7 10 | $1.90½ | 13 8 | $3.32½ |
| Hereford, via Great Western Ry., 55 miles | 31 1 | 7.56 | 17 5 | 4.23 | 13 8 | 3.32½ |
| Swindon, via Great Western Ry., 75 miles | 37 0 | 9.00 | 23 4 | 5.68 | 13 8 | 3.32½ |
| Birmingham, via Midland Ry., 114 miles | 46 4 | 11.27 | 32 8 | 7.95 | 13 8 | 3.32½ |
| Manchester, via London and Northwestern Ry., 168 miles | 67 4 | 16.38 | 53 8 | 13.06 | 13 8 | 3.32½ |
| Leeds, via Midland Ry., 205 miles | 75 2 | 18.29 | 61 6 | 14.96 | 13 8 | 3.32½ |
| Newcastle, via London and Northwestern and North-eastern Rys., 303 miles | 90 0 | 19.46 | 76 4 | 18.57 | 13 8 | 3.32½ |
| Reading, via Great Western Ry., 116 miles | 47 0 | 11.43 | 33 4 | 8.11 | 13 8 | 3.32½ |
| Helmsdale, via London and Northwestern, Caledonian Highland Rys., 640 miles | 165 0 | 40.14 | 151 4 | 36.82 | 13 8 | 3.32½ |
| Perth, via London and Northwestern and Caledonian Rys., 420 miles | 122 6 | 29.80 | 108 10 | 26.48 | 13 8 | 3.32½ |

NOTES ON TABLE NO. 10.

(*c*) Terminal charges are the maximum allowed by act of Parliament. The services rendered are as follows: Use of stations at each end, 3s. (73 cents); loading, 1s. 8d. (40.55 cents); unloading, 1s. 8d. (40.55 cents); covering and uncovering, 8d. (16.22 cents); cartage—the railroad company collecting the freights from the merchant and delivering to consignee—3s. 4d. (81 11 cents) each end; total cartage, $1,6222. These items total the sum shown in the table for terminal charges, viz, $3.32½.

(*e*) These rates are in Class 5, the highest in the railway schedule. They cover such commodities as barometers, boots, sewing machines, wines, etc., and refer only to freight trains. British railroads do not distinguish between slow and fast freight, and where they operate fast freight trains between important centers, make no additional charge. The fair comparison with express business is to be found in Table 11.

TABLE NO. 11.—*Showing comparisons with American express business.*

[Freight by passenger trains.]

| Weight. | Up to 30 miles. | | 30 miles to 50 miles. | | 50 miles to 100 miles. | | Over 100 miles. | |
|---|---|---|---|---|---|---|---|---|
| *Pounds.* | *d.* | *Cents.* | *s. d.* | *Cents.* | *s. d.* | *Cents.* | *s. d.* | *Cents.* |
| 2 | 4 | 0.0811 | 4 | 0.0811 | 4 | 0.0811 | 4 | 0.0811 |
| 3 | 5 | .1013 | 5 | .1013 | 5 | .1013 | 5 | .1013 |
| 4 | 6 | .1216 | 6 | .1216 | 6 | .1216 | 6 | .1216 |
| 5 | 6 | .1216 | 6 | .1216 | 7 | .1419 | 7 | .1419 |
| 6 | 6 | .1216 | 6 | .1216 | 8 | .1622 | 8 | .1622 |
| 7 | 6 | .1216 | 8 | .1622 | 9 | .1824 | 9 | .1824 |
| 8 | 6 | .1216 | 8 | .1622 | 10 | .2027 | 10 | .2027 |
| 9 | 6 | .1216 | 8 | .1622 | 11 | .2230 | 11 | .2230 |
| 10 | 6 | .1216 | 8 | .1622 | 1 0 | .2433 | 1 0 | .2433 |
| 11 | 6 | .1216 | 8 | .1622 | 1 0 | .2433 | 1 0 | .2433 |
| 12 | 6 | .1216 | 8 | .1622 | 1 0 | .2433 | 1 1 | .2635 |
| 13 | 6 | .1216 | 9 | .1824 | 1 1 | .2635 | 1 2 | .2838 |
| 14 | 6 | .1216 | 9 | .1824 | 1 1 | .2635 | 1 3 | .3040 |
| 15 | 6 | .1216 | 9 | .1824 | 1 2 | .2838 | 1 4 | .3244 |
| 16 | 6 | .1216 | 10 | .2027 | 1 2 | .2838 | 1 5 | .3446 |
| 17 | 6 | .1216 | 10 | .2027 | 1 3 | .3040 | 1 6 | .3649 |
| 18 | 6 | .1216 | 10 | .2027 | 1 3 | .3040 | 1 7 | .3852 |
| 19 | 6 | .1216 | 11 | .2230 | 1 4 | .3244 | 1 8 | .4055 |
| 20 | 6 | .1216 | 11 | .2230 | 1 4 | .3244 | 1 9 | .4257 |
| 21 | 6 | .1216 | 11 | .2230 | 1 5 | .3446 | 1 10 | .4460 |
| 22 | 6 | .1216 | 1 0 | .2433 | 1 5 | .3446 | 1 11 | .4663 |
| 23 | 6 | .1216 | 1 0 | .2433 | 1 6 | .3649 | 2 0 | .4866 |
| 24 | 6 | .1216 | 1 0 | .2433 | 1 6 | .3649 | 2 0 | .4866 |
| 25 | 7 | .1419 | 1 1 | .2635 | 1 7 | .3852 | 2 1 | .5068 |
| 26 | 7 | .1419 | 1 1 | .2635 | 1 8 | .4055 | 2 2 | .5270 |
| 27 | 7 | .1419 | 1 2 | .2838 | 1 9 | .4257 | 2 3 | .5473 |
| 28 | 7 | .1419 | 1 2 | .2838 | 1 9 | .4257 | 2 4 | .5676 |
| 29 | 8 | .1622 | 1 3 | .3040 | 1 10 | .4460 | 2 5 | .5879 |
| 30 | 8 | .1622 | 1 3 | .3040 | 1 11 | .4663 | 2 6 | .6082 |
| 31 | 8 | .1622 | 1 4 | .3244 | 2 0 | .4866 | 2 7 | .6285 |
| 32 | 8 | .1622 | 1 4 | .3244 | 2 0 | .4866 | 2 8 | .6488 |
| 33 | 9 | .1824 | 1 5 | .3446 | 2 1 | .5068 | 2 9 | .6690 |
| 34 | 9 | .1824 | 1 5 | .3446 | 2 2 | .5270 | 2 10 | .6893 |
| 35 | 9 | .1824 | 1 6 | .3649 | 2 3 | .5473 | 2 11 | .7096 |

TABLE No. 11.—*Showing comparisons with American express business*—Continued.

*Charge for parcels above 35 pounds in weight.*

| | Rate per pound. | |
|---|---|---|
| | *d.* | *Cents.* |
| Any distance under 30 miles | ½ | ½ |
| Any distance between 30 and 50 miles | 1 | 1 |
| Any distance between 50 and 100 miles | 1½ | 1.5 |
| Any distance above 100 miles | 1 | 2.02 |

NOTES ON TABLE No. 11.

The rates are total, e. g., a package weighing under 2 pounds may be sent any distance over the railway for 8.11 cents.

All railroads carry parcels by their passenger trains, and the rates, by mutual agreement, are as above throughout Great Britain, except for slight variations in Scotland. They thus do the express business themselves—promptly, efficiently, and cheaply. The above charges include collection and delivery, except in country places where they have no road wagons. The parcels are forwarded by first passenger train after collection and are promptly delivered from receiving depot. Parcels sent from Cardiff by morning train might be delivered to consignee in London—152 miles—that evening. Railroad companies, in addition to collecting, maintain many "parcel receiving offices" in large cities, the Great Western, for instance, maintaining 18 in Bristol, 34 in Birmingham, and 37 in Liverpool.

TABLE No. 12.—*Farm and dairy produce by passenger trains.*

| Weight. | Up to 30 miles. | | 31 to 50 miles. | | 51 to 100 miles. | | 100 to 200 miles. | | | Over 200 miles. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *d.* | *Cents.* | *d.* | *Cents.* | *d.* | *Cents.* | *s.* | *d.* | *Cents.* | *s.* *d.* | *Cents.* |
| 10 pounds | 6 | 12.16 | 6 | 12.16 | 6 | 12.16 | 8 | | 16.22 | 9 | 18.24 |
| 24 pounds | 6 | 12.16 | 6 | 12.16 | 9 | 18.24 | 1 | 0 | 24.33 | 1 3 | 30.40 |
| Above 24 pounds[a]....per lb | ⅛ | .25 | ¼ | .5 | ⅜ | .75 | | ½ | 1 | ⅝ | 1.25 |

[a] Minimum charge, 12+ cents.

The above are the special rates of the Great Western Railway for small consignments of butter, cream, fish, eggs, game, poultry, vegetables, flowers, etc. Rates include collection and delivery, though in practice most of the perishable goods are brought by shipper to the "parcels office" of the passenger depot, whence they are dispatched by the first outgoing passenger train.

TABLE No. 13.—*Illustrations of class rates.*

| (*a* and *b*.) From Cardiff to— | (*c* and *e*.) Total rate per ton of 2,240 pounds. | | | | | |
|---|---|---|---|---|---|---|
| | Class B. | | Class C. | | Class 1. | |
| | *s.* *d.* | | *s.* *d.* | | *s.* *d.* | |
| Aberdare, via Taff Vale Ry., 24 miles | 3 4 | $0.8111 | 6 0 | $1.46 | 8 9 | $2.13 |
| Hereford, via Great Western Ry., 55 miles | 5 11 | 1.44 | 8 9 | 2.13 | 14 10 | 3.61 |
| Swindon, via Great Western Ry., 75 miles | 7 7 | 1.84 | 11 11 | 2.90 | 18 0 | 4.38 |
| Birmingham, via Midland Ry., 114 miles | 7 10 | 1.91 | 10 6 | 2.56 | 17 6 | 4.26 |
| Reading, via London and Northwestern Ry., 116 miles | 10 0 | 2.43 | 15 4 | 3.73 | 22 2 | 5.39 |
| Manchester, via Midland Ry., 168 miles | (a) | (a) | 21 0 | 5.11 | 31 6 | 7.66 |
| Leeds, via London and Northwestern and Northeastern Rys., 205 miles | 14 10 | 3.61 | 23 7 | 5.74 | 35 0 | 8.52 |
| Newcastle, via Great Western Ry., 303 miles | 17 10 | 4.34 | 27 11 | 6.79 | 41 8 | 10.14 |
| Perth, via London and Northwestern and Caledonian Rys., 420 miles | (a) | (a) | 35 0 | 8.52 | 48 4 | 11.76 |
| Helmsdale, via London and Northwestern and Caledonian Highland Rys., 640 miles | (a) | (a) | 50 0 | 12.17 | 66 8 | 16.22 |

[a] No rate.

TABLE NO. 13.—*Illustrations of class rates*—Continued.

| (*a* and *b*.) From Cardiff to— | (*c* and *e*.) Total rate per ton of 2,240 pounds. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class 2. | | | Class 3. | | | Class 4. | | | Class 5. | | |
| | *s.* | *d.* | | *s.* | *d.* | | *s.* | *d.* | | *s.* | *d.* | |
| Aberdare, via Taff Vale Ry., 24 miles | 10 | 6 | $2.55 | 14 | 0 | $3.40 | 17 | 7 | $4.28 | 21 | 6 | $5.23 |
| Hereford, via Great Western Ry., 55 miles | 18 | 4 | 4.46 | 21 | 9 | 5.29 | 25 | 9 | 6.26 | 31 | 0 | 7.56 |
| Swindon, via Great Western Ry., 75 miles | 22 | 0 | 5.35 | 25 | 0 | 6.08 | 30 | 4 | 7.38 | 37 | 0 | 9.00 |
| Birmingham, via Midland Ry., 114 miles | 22 | 9 | 5.54 | 28 | 0 | 6.81 | 37 | 10 | 9.21 | 46 | 4 | 11.27 |
| Reading, via London and Northwestern Ry., 116 miles | 27 | 8 | 6.73 | 31 | 10 | 7.75 | 38 | 5 | 9.35 | 47 | 0 | 11.44 |
| Manchester, via Midland Ry., 168 miles | 36 | 9 | 8.94 | 45 | 6 | 11.07 | 55 | 11 | 13.60 | 67 | 4 | 16.38 |
| Leeds, via London and Northwestern and Northeastern Rys., 205 miles | 43 | 9 | 10.64 | 52 | 0 | 12.65 | 62 | 6 | 15.21 | 75 | 2 | 18.29 |
| Newcastle, via Great Western Ry., 303 miles | 52 | 6 | 12.77 | 63 | 9 | 15.51 | 76 | 8 | 18.66 | 90 | 0 | 21.90 |
| Perth, via London and Northwestern and Caledonian Rys., 420 miles | 58 | 4 | 14.20 | 75 | 0 | 18.25 | 100 | 0 | 24.33 | 122 | 6 | 29.80 |
| Helmsdale, via London and Northwestern and Caledonian Highland Rys., 640 miles | 78 | 4 | 19.05 | 103 | 4 | 25.14 | 135 | 0 | 32.85 | 165 | 0 | 40.15 |

NOTES ON TABLE NO. 13.

These rates are in nearly all cases the maximum allowed by law both for transport and terminal work. The exceptions (Cardiff to Birmingham, for instance) indicate strong competition.

For Class A, which consists of such material as coal, iron ore, stone direct from the quarries, gas lime, etc., the railways always quote special rates, but such rates would be maximum unless quantities were large.

*Class B.*—Typical products: Cement, patent fuel, building stone, lime, common drain pipes, bricks, scrap iron, tin-plate bars.

If large or regular consignments can be made, railways will generally "cut" Class B rates.

Thus: Bricks and tiles, Cardiff to Aberdare—24 miles—are carried at a special rate, 2s. 11½d. (71.96 cents), instead of the class rate, 3s. 4d. (81.11 cents). Scrap iron or pig iron, Cardiff to Birmingham—114 miles—special rate, 7s. 1d. ($1.7234); class rate, 7s. 10d. ($1.9059). Scrap iron or pig iron, Cardiff to Leeds, special rate, 12s. 6d. ($3.0414); class rate, 14s. 10d. ($3.6092).

*Class C.*—Typical products: Grain, rails, railway carriage and wagon work, steel plates, wire, paper-making material.

A large number of special rates are in force for freight in this class. Grain and flour are nearly always carried between important points below Class C rates, for instance:

| Cardiff to— | Grain rates. | | | | | | Class C rates (2-ton lots). | | |
|---|---|---|---|---|---|---|---|---|---|
| | 4-ton lots. | | | 2-ton lots. | | | | | |
| | *s.* | *d.* | | *s.* | *d.* | | *s.* | *d.* | |
| Aberdare | 4 | 2 | $1.0138 | 4 | 4 | $1.0544 | 6 | 0 | $1.46 |
| Hereford | 6 | 8 | 1.1622 | 7 | 10 | 1.9059 | 8 | 9 | 2.1290 |
| Birmingham | 8 | 4 | 2.0277 | 8 | 9 | 2.1290 | 10 | 6 | 2.5548 |
| Reading | 11 | 10 | 2.88 | 13 | 11 | 3.3862 | 15 | 4 | 3.7308 |

*Class 1.*—Typical products: Heavy machinery, builders' implements, light castings packed, flax and jute, raw cotton, oils in casks, hay and straw, paper for news or hanging, resin.

More of Class 1 freight is carried under class rates than in Classes B and C. There are, however, numerous special rates—for instance:

| Cardiff to— | Article. | Special rate. | | | Class rate. | | |
|---|---|---|---|---|---|---|---|
| | | *s.* | *d.* | | *s.* | *d.* | |
| Birmingham | Paper for printing | 15 | 10 | $3.85 | 17 | 6 | $4.26 |
| Manchester | do | 20 | | 4.87 | 31 | 6 | 7.66 |
| Leeds | Oils | 28 | 10 | 7.02 | 43 | 9 | 10.64 |

TABLE No. 13.—*Illustrations of class rates*—Continued.

*Classes 2 to 5: Typical products.*

| Class 2. | Class 3. | Class 4. | Class 5. |
|---|---|---|---|
| Agriculture seeds. | Textile. | Books. | Aluminum. |
| Bacon and hams. | Manufactures. | Wax candles. | Barometers. |
| Biscuits. | Cutlery. | Light drapery. | Cigars and cigarettes. |
| China. | Light chemicals. | Lace. | Spices. |
| Oranges. | Glass. | Implements for sports. | Light drugs. |
| | Groceries. | Fresh meat and poultry. | Game. |
| | | Preserves. | Furs. |
| | | | Live poultry. |

*Class B.*—(*c* and *d*). The rates given in Table No. 13 includes station terminals of 1s. (24.33 cents) per ton—6d. (12.16 cents) at each end. If the freight is taken to or from a trader's siding, the station terminal is not charged, but a charge of about half the station terminal is levied for switching, etc., at the trader's siding. Rates are from station to station, and do not include collection or delivery.

(*f*) The merchandise included in this class is usually carried in open trucks—about 10 tons tare—and loading and unloading is done by trader.

The rates are for minimum consignments of 4 tons, and when under, Class C rates, less 1s. (24.33 cents) are charged.

*Class C.*—(*c* and *d*). The rates in Table No. 13 include station terminals of 2s. (48.66 cents) per ton—1s. (24.33 cents) at each end; also 3d. (6.07 cents) for covering and 3d. (6.07 cents) for uncovering.

(*f*) Minimum consignment, 2 tons; if under Class 1 rates apply, less 1s. 5d. (34.46 cents) per ton.

*Classes 1 to 5.*—(*c* and *d*). The rates in Table No. 13 include the following charges for terminal services:

*Charge for terminal services included in rate.*

| Service. | Class— | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1. | | | 2. | | | 3. | | | 4. | | | 5. | | |
| | s. | d. | | s. | d. | | s. | d. | | s. | d. | | s. | d. | |
| Provision of stations at each end | 3 | 0 | $0.73 | 3 | 0 | $0.73 | 3 | 0 | $0.73 | 3 | 0 | $0.73 | 3 | 0 | $0.73 |
| Loading | | 5 | .1013 | | 8 | .1622 | 1 | 0 | .2433 | 1 | 4 | .3244 | 1 | 8 | .4055 |
| Unloading | | 5 | .1013 | | 8 | .1622 | 1 | 0 | .2433 | 1 | 4 | .3244 | 1 | 8 | .4055 |
| Covering | | 1½ | .0303 | | 2 | .0405 | | 2 | .0405 | | 3 | .0607 | | 4 | .0811 |
| Uncovering | | 1½ | .0303 | | 2 | .0405 | | 2 | .0405 | | 3 | .0607 | | 4 | .0811 |
| Cartage between stations and consignor and consignee's houses | 4 | 0 | .9733 | 4 | 0 | .9733 | 4 | 0 | .9733 | 5 | 0 | 1.2165 | 6 | 8 | 1.6222 |
| Total included for terminal in each of the rates given | 8 | 1 | 1.9665 | 8 | 8 | 2.1087 | 9 | 4 | 2.2709 | 11 | 2 | 2.7167 | 13 | 8 | 3.3254 |

The railways generally load, unload, collect, and deliver freights in Classes 1 to 5. If the trader carts at either end, a deduction is made.

(*f*) The rates for Classes 1 to 5 are for any weights, but railways will not collect nor deliver any article over 3 tons in weight unless by special arrangement.

Railways, by law, can make an addition to class rates in respect of consignments under 3 hundredweight in weight.

This addition is 5d. (10.13 cents) per consignment when the total charge on the parcel does not exceed 20s. ($4.86); and it gradually advances to a maximum of 1s. 6d. (36.49 cents) per consignment when the total railway charges on the consignment exceed £5 ($24.33).

In "Railway Rates and Charges of the United Kingdom," page 127, is given the scale actually in force for such small consignments on all the railways in England and Wales. As instances of the working of this system, the following may be given:

| Weight of parcel. | Class rate per ton. | | Total railway charge if class rates applied. | | Actual charge made by railway. | |
|---|---|---|---|---|---|---|
| *Cwt.* | *s. d.* | | *s. d.* | | *s. d.* | |
| 2½ | 20 0 | $4.86 | 2 6 | $0.6082 | 2 10 | $0.6894 |
| 2 | 40 0 | 9.73 | 4 0 | .9733 | 4 7 | 1.12 |
| 3 | 60 0 | 14.60 | 9 0 | 2.19 | 9 8 | 2.35 |
| 3 | 120 0 | 29.20 | 18 0 | 4.38 | 18 11 | 4.60 |

A slightly greater addition than the above, about 1d. (2 cents) per parcel more, is made on parcels to or from places in Scotland and Ireland.

## *Question VI.*

### ARE THE FREIGHT RATES BASED ABSOLUTELY ON DISTANCE, OR IS THE RATE PER TON-MILE LESS FOR LONGER DISTANCES?

The acts of Parliament which fix the maximum rates reduce the ton-mile rate as the haul gets longer, and British railways adopt the principle even when charging under maximum.

The acts fix the highest rate for the first 20 miles, lower for the next 30 miles, lower for the next 50 miles, and still lower for the remainder of the distance.

The table which follows is typical and will illustrate the practice of all British railways:

MAXIMUM RATES—GREAT WESTERN RAILWAY.

[Per ton of 2,240 pounds per mile. One penny=2.0277 cents.]

| For merchandise in— | For the first 20 miles or any part of such distance. | | For the next 30 miles or any part. | | For the next 50 miles or any part. | | For the remainder of distance. | |
|---|---|---|---|---|---|---|---|---|
| | *d.* | | *d.* | | *d.* | | *d.* | |
| Class A | 1.5 | $0.0304 | 0.9 | $0.0182 | 0.4 | $0.0081 | 0.35 | $0.0071 |
| Class B | 1.6 | .0324 | 1.2 | .0243 | .8 | .0162 | .5 | .0101 |
| Class C | 1.8 | .0365 | 1.5 | .0304 | 1.2 | .0243 | .7 | .0142 |
| Class 1 | 2.2 | .0446 | 1.35 | .0274 | 1.4 | .0284 | 1.0 | .0203 |
| Class 2 | 2.65 | .0537 | 2.3 | .0466 | 1.8 | .0365 | 1.5 | .0304 |
| Class 3 | 3.1 | .0628 | 2.65 | .0537 | 2.0 | .0405 | 1.8 | .0365 |
| Class 4 | 3.6 | .0730 | 3.15 | .0639 | 2.5 | .0507 | 2.2 | .0446 |
| Class 5 | 4.3 | .0872 | 3.7 | .0750 | 3.25 | .0660 | 2.5 | .0507 |

Railroads do not, of course, adhere rigidly to the rule of proportionate decrease of rates as distance increases. Many conditions, competition, volume of traffic, etc., affect the rule; but, *ceteris paribus*, they reduce their ton-mile rates after the first 20, next 30, and next 50 miles.

As an example of this, the following are the rates on grain imported at Cardiff docks and conveyed to the undermentioned stations by the Great Western Railway:

| Station to which sent and distance. | Total charge, transport and terminal. | | Deduct, say, ⅛ for terminal. | | Net charge for transport. | | Charge per ton per mile. |
|---|---|---|---|---|---|---|---|
| | s. d. | | s. d. | | s. d. | | |
| Abercarn, 20 miles | 4 4 | $1.0544 | 1 6 | $0.3650 | 2 10 | $0.6894 | $0.0344 |
| Resolven, 43 miles | 5 3 | 1.2774 | 1 6 | .3650 | 3 9 | .9124 | .0212 |
| Carmarthen, 75 miles | 7 10 | 1.9060 | 1 6 | .3650 | 6 4 | 1.5410 | .0205 |
| Goodwick, 117 miles | 10 6 | 2.5548 | 1 6 | .3650 | 9 0 | 2.1898 | .0187 |
| Paddington, 152 miles | 12 6 | 3.0415 | 1 6 | .3650 | 11 0 | 2.6765 | .0178 |

The terminal charge of 36½ cents per ton is an estimate, as there is no exact means of separating such charge from the total. It is closely approximate to the amount which the railway would consider a fair return for the terminal work performed.

The various tables given in preceding pages also show that the diminishing ton-mile rate applies on different railways and to various commodities.

The question of ton-mileage statistics has been the subject of consideration by the Birmingham Chamber of Commerce, and on November 30, 1909, a joint report was made by the railway rates committee of said chamber, and the coal-trade section of that body, as to the importance of ton-mileage statistics.

This report, as it appears on the records of the said chamber of commerce, is as follows:

The committee and section having, as a joint meeting, considered the question of ton-mileage statistics, which at the last meeting of the council was referred back to them, beg to report as follows with reference to the proposals contained in the report of the coal-trade section on the subject of the preparation by the railway companies of ton-mileage statistics.

1. In the report of the departmental committee on railway accounts published recently it is stated that ton-mileage statistics have been used in India for at least forty years, and for a longer period in America. They are now compiled by railways of nearly all foreign countries—Portugal and Belgium being the most important exceptions. The only English railway which at present employs this group of statistics in the conduct of its business is the Northeastern, though figures of this nature are taken out occasionally or for particular traffics by one or two other companies.

2. In the report it is also stated that the system of statistics based upon ton-mileage takes as its foundation the principle of combining in a comprehensive figure the two factors of weight and distance, the fundamental unit being 1 ton carried 1 mile. Among the more important statistics deduced from ton-mile statistics may be mentioned:

(*a*) The average train load of goods, obtained by dividing the ton-mileage by the train mileage.

(*b*) The average wagon load, obtained by dividing the ton-mileage by the wagon mileage.

(*c*) Ton-miles per engine hour.

(*d*) The average length of haul for goods, obtained by dividing the ton-mileage by the total tonnage conveyed.

(*e*) The average receipts per ton per mile, obtained by dividing the goods receipts by the ton-mileage.

(*f*) The average density of goods traffic per mile of road or per mile of track, obtained by dividing the ton-mileage by the length of road or by the length of track.

3. The report further states that it is generally admitted that some useful purpose is served by statistics which, from their comprehensive nature, may be used to indicate in a general way the condition of the business from year to year. The only figure available for this purpose at present in the case of English railways is that of average gross receipts per train mile, which expresses the relation between the gross receipts and

the number of train miles run. But, as the departmental committee states, the reliability for comparative purposes from year to year of the average receipts per train mile continues only so long as the average rate obtained remains constant. It is clear, for instance, that a rise in the average receipts per train mile may be attributable to improvements in loading, but, equally, it may be due to an increase in the rates charged or to a change in the average length of haul or to an alteration in the relative proportions of high-class traffic and of traffic carried at low rates. The average receipts per train mile do not, however, afford the material for distinguishing between these two wholly different sets of causes because they contain two variables and introduce confusion by mixing the records of the actual works performed with those of the price received in payment for that work.

4. After an exhaustive report on their investigations the majority, viz, six members out of nine, of the departmental committee summed up their conclusions by stating (inter alia) that they have been impressed by the evidence given by certain witnesses tending to show that although ton-mile statistics can not in any way be used to replace the methods of continuous supervision and check by subordinate officers over the efficient loading of wagons and over the economical working of our railways in other respects, yet they may often form a useful supplement thereto. The value of this group of statistics, the majority say, appears to lie principally in the information which it places in the hands of the higher officials and directors of the companies with regard to the extent to which efficiency has been secured and improvements in working generally have been effected. Where and in so far as rates on the whole remain constant, earnings per train mile may, no doubt, be used for a similar purpose. But, in the words of the majority, the general trend of evidence seems to indicate that rates for goods are on the whole declining, though slowly. The use of ton-mile statistics would place at the disposal of railway directors a method of separating the two principal causes which, on any individual railway, affect the earnings per train mile, namely, changes in average train load and changes in average charges.

5. In the majority report it is stated that there is reason to think, for example, that a knowledge of the average rate per ton-mile charged by English railway companies would provide material for a more definite answer than can at present be given to the charge sometimes brought against our railways, that English goods rates are the highest in the world. Sir George Gibbs, a former general manager of the Northeastern, said to the committee that the attacks on British railways were mainly due to the ignorance of writers as to the effect of the long haul and the short haul. "I venture to say," he added, "that if material for these was available you would, within twelve months, have a complete change of public opinion with regard to railway rates. I believe the attacks on English railway rates mainly owe their success to the fact that the defenders have their hands tied in the contest, because they have not got the material with which to give an adequate answer."

6. The chamber has never yet joined in the general attack on English railway rates, but has always endeavored to deal with each case brought forward temperately and on its merits. If the hands of the railway companies are tied owing to the absence of material, how much more must the hands of the trader be tied when he has little, if any, material available to guide him as to the cost of transport beyond the comparison of English rates and foreign rates as quoted. In cases brought before the railway and canal traffic commission great volumes of ad hoc information are produced by the railway companies which they are unable to prove, and the trader is unable to disprove; and it is not therefore to be wondered at that such statistics as to cost of traffic are regarded by the public with the suspicion to which they must naturally be subject under the circumstances. If by the preparation of ton-mile statistics more accurate information can be adduced, and if, as Sir George Gibbs states, this would have such good results, it is difficult to conceive what reason the railway companies can have for refusing to compile them. If, on the other hand, the railway companies persist in their present attitude, it does not appear unreasonable to suggest that ton-mile statistics would help to prove the traders' case.

7. The majority of the departmental committee say that the more they consider the arguments adduced on both sides of the controversy, the more strongly they became convinced of the practical value of the ton-mile system. They quoted Mr. C. M. Hays, the general manager of the Grand Trunk Railway of Canada, as saying that though his railway would have made progress without ton-mile statistics, it would not have been so intelligent a progress.

8. There is also, the majority report states, no doubt that from the point of view of the general statistics of the country, considerable value would attach to information which, taken over a period of years, would throw light on the extent to which the charges made by railway companies have on the whole declined, and which would

also afford some measure of the actual work performed by the companies in the carrying of goods.

9. The report further states that there is reason to think that these statistics would furnish material for valuable and instructive comparisons between the results obtained at different periods, not only on British railways as a whole, but especially on a given railway. They might be useful also for comparisons between different railways where a reasonable similarity of conditions exists. Furthermore, as the majority say, the information would "often be of service in replying to attacks made upon railway companies in this country." For these purposes they conclude ton-mile statistics would be useful to those actually responsible for railway working, to railway shareholders, and to the general public.

10. One of the objections against ton-mile statistics which was urged to the committee was that they might be used as a basis for misleading conclusions, but as the majority say: "Any statistics may be used" for this purpose. "The positive objections urged against ton-mile statistics, so far as they have been put before us, appear in every case to apply only to the misuse of the figures." There does not appear to be much substance in such objections as these.

11. The majority of the departmental committee make out a very strong case for the preparation of ton-mile statistics, and say, "we recommend this class of statistics to the careful consideration of those responsible for railway working in this country with a view to seeing whether they can not be more widely introduced." Three of the gentlemen who signed the majority report were, however, against ton-mile statistics being made statutory, except where a strong demand is made on behalf of the public. They state that there is no evidence of any such demand and that the shareholders and the general public appear, so far as they are able to judge, to show little interest in the question. Seeing, however, that they only examined 29 witnesses, that 12 of these were officials of British railway companies, 8 connected with Indian railways, 3 directors of English railways, 2 officials of Argentine and Canadian railways, respectively, 2 officers past and present of the British Board of Trade, the secretary of the railway clearing house, and 1 chairman of the railway shareholders' committee, it is hardly to be expected that they would be able to gauge the extent or importance of the public demand. Mr. Burdette-Coutts, who represented the railway shareholders' committee, was in favor of the adoption of ton-mile statistics.

12. The three members of the committee who signed the majority report with a reservation in favor of statutory ton-mile statistics were Mr. W. M. Acworth, a well-known authority and writer upon railway questions, Mr. George Paish, editor of the Statist, and the Hon. George Peel, who represents £7,000,000 ($35,000,000) of railway stock, and who took a leading part in the agitation of London and Northwestern shareholders for improved accounts and statistics. These gentlemen in their "reservation" say that there is evidence of a widespread and growing interest in the subject, and that the information of several committees of shareholders is a sign of public opinion which can not be ignored. They conclude as follows: "Finally we are of opinion that our colleagues have not given sufficient weight to the interests of the public which in this matter coincides with those of shareholders. If the control of the British Board of Trade and of Parliament over the railways is to be wise and salutary, it must be based on adequate knowledge. Adequate knowledge can not exist until comprehensive information is produced showing the total amount of work done by the railway companies for the public, and the average charge made to the public for doing it."

13. It now remains for your committee and trade section to deal with the two objections made at the last meeting, when the recommendation of the coal-trade section was discussed by the council. These were: (*a*) That it would not be just to compel a railway company to disclose figures which a manufacturer in his own interest keeps to himself, and (*b*) that it would be unfair to throw upon the railway companies the cost of preparing ton-mile statistics. In regard to these objections the report of the majority of the departmental committee is as follows:

(*a*) Though it is natural that individual railway companies should not be willing to publish certain information except on the understanding that other railway companies do the same, the evidence has tended to show that no general objection is entertained by the companies to the publication of ton-mile figures as being likely to involve the disclosure of information which they would wish, having regard to their private interests, to keep secret.

(*b*) The cost involved in the compilation of ton-mile statistics would not, so far as we have been able to judge, be very great, and the companies do not appear to regard the cost as an obstacle, provided that the result of the expenditure incurred can be shown to be useful.

14. It should be mentioned that the recommendations of the departmental committee were unanimous in regard to all the other statutory accounts which it is considered should be kept by railway companies. The three railway representatives waived their objections on points of detail owing to their belief in the paramount importance of uniformity in the form and scope of the information now supplied by railway companies.

15. After very careful consideration of the report of the departmental committee, the railway rates committee and the coal-trades section unanimously recommend that the council of the chamber adopt the following resolution:

"That in the opinion of this chamber, in council assembled, it is important in the interests of railway companies and shareholders and traders, that legislation should be introduced at the earliest possible date to give effect to the recommendation contained in the recent report of the departmental committee on railway accounts and statistics; but that it is also essential that provision should be made in the statutory accounts for the compilation and publication of ton-mileage statistics.

That a copy of this resolution be forwarded to the president of the British Board of Trade."

JOHN L. GRIFFITH,
*Consul-General.*

LONDON, ENGLAND, *December 11, 1909.*

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# RAILWAY FREIGHT RATES INLAND WATERWAYS AND CANALS IN HOLLAND

REPORTS BY

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AND

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WASHINGTON

GOVERNMENT PRINTING OFFICE

1910

## NATIONAL WATERWAYS COMMISSION

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# RAILWAY FREIGHT RATES, INLAND WATERWAYS, AND CANALS IN HOLLAND.

By Henry H. Morgan,

*American Consul at Amsterdam.*

This report is in answer to questions prepared by the National Waterways Commission and the Department of Commerce and Labor and transmitted to American consuls through the Department of State.

## Chapter I.

### QUESTIONS RELATING TO FOREIGN RAILWAY RATES SUBMITTED BY THE NATIONAL WATERWAYS COMMISSION THROUGH THE DEPARTMENT OF STATE.

I. Give ten examples of rates on coal on different railway lines for different distances, with the following details:

(*a*) Give termini for each shipment.

(*b*) Give distances of each shipment, including in the list of ten rates at least three rates for the maximum distance that coal is shipped.

(*c*) Give separately the terminal and transportation charge. (If this is not possible, make note of the fact that the two are combined.)

(*d*) State what service is covered by the terminal charge.

(*e*) State the class of rate into which the coal traffic falls; that is, whether the rate is a special or commodity rate or a normal class rate, and, if the latter, what class.

(*f*) Give all other facts concerning method of shipment which affect the rate, such, for example, as minimum carload weight or minimum train load, open or closed cars, fast or slow freight, and the like.

(*g*) If any of these rates have been given to encourage the development of any industry, state the facts.

II. Answer the above seven questions (*a* to *g*), quoting in each case ten examples of rates on different railway lines for different distances for the following commodities: 1, iron ore; 2, stone; 3, lumber; 4, fertilizer; 5, grain.

III. Give ten illustrations of special rates granted to export business on different railways for different distances, and answer in each case the questions propounded above for the coal traffic (*a* to *g*) so far as they are applicable to the export business. Make a statistical tabulation comparing these export rates with local rates between the same termini.

IV. Give ten illustrations of rates charged by different railways for different distances on the highest grade of classified freight, that which, in many countries, corresponds to the express business of the United States, and answer in each case the questions propounded for the coal traffic (*a* to *g*).

V. Give ten illustrations of rates charged by different railways for different distances on typical products included in the various categories of the regular freight classification, showing both carload and less than carload rates, and answer in each case the questions propounded for the coal traffic (*a* to *g*).

VI. Are the freight rates based absolutely on distance, or is the rate per ton-mile less for longer distances? Show, in the case of different commodities, at what distances the fall in the rate per ton-mile takes place.

## Chapter II.

### QUESTIONS SUBMITTED BY THE DEPARTMENT OF COMMERCE AND LABOR THROUGH THE DEPARTMENT OF STATE RELATIVE TO RIVERS AND CANALS IN FOREIGN COUNTRIES.

#### I.—PUBLIC SUPERVISION.

(*a*) State what public authority, national, state, or local, exercises supervision in the different instances over navigable streams and canals.

(*b*) What are the powers and duties of such officials in regard to the following:

(1) Capitalization of navigation corporations.
Regulation of freight rates.
Reports of operation.
Maintenance and improvement of channels, docks, and terminal facilities.

(2) Collection of statistics of water-borne traffic, and by what agencies such statistics are compiled and published.

#### II.—WATERWAY IMPROVEMENTS.

(*a*) Is there any established policy as to water powers developed by works constructed for improving navigation? Give illustrations.

(*b*) To what general extent have river improvements and the construction of canals been carried on by the central government, by local governments, and by private enterprise? Give typical and important illustrations of each. Describe any system of cooperation and contribution between the central government and local government in such works.

#### III.—FLOATING EQUIPMENT.

(*a*) What is the general character of vessels used on rivers and canals?

(1) The relative use of self-propelled vessels and towed vessels.
(2) Motive power for barges and canal boats.
(3) Size and draft of vessels.
(4) The use of iron, steel, and wood in vessel construction.
(5) The cost of various types of boats.
(6) The use of special types of boats for particular cargoes and on different classes of waterways.
(7) The size of fleets of barges.
(8) Is the type of boats adapted to low-water stages, or are they constructed with a view to utilization in high water?

In each case specific information is desired showing the situation in typical instances rather than general statements of a summary character.

#### IV.—OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

(*a*) Do canal companies or other waterway improvement companies own and operate vessels? Give examples.

(*b*) Are there important cases of consolidation of vessel owners into large corporations operating extensive fleets on inland waterways?

(*c*) To what extent are vessels owned and operated by railroads, or by producing and distributing concerns, such as coal, oil, lumber, ore, etc., fleets? Give examples.

(*d*) Are there any fleets of merchant vessels owned and operated by public authorities? Give examples.

(*e*) Are there important instances of combinations or monopolies controlling towing on canals and rivers? Give examples.

#### V.—TERMINAL FACILITIES.

(*a*) What are the important or striking physical features of river and canal terminals such as docks, wharves, piers, and floating wharf boats? Give illustrations and send photographs with this answer.

(*b*) Describe the most advanced methods of loading and unloading vessels on inland waterways, including the use of mechanical appliances.

(*c*) Are railroad tracks located on terminals of inland waterways, permitting direct transfer between railroad and water lines? Do such railroad tracks form a belt railroad, connecting all the railroads at a given port? Give examples.

(*d*) Are river and canal terminals owned by public or private interests? Are they owned at all by private railways? If so, give the important instances.

### VI.—TOLLS AND FREIGHT RATES.

(*a*) Are tolls charged on canals and rivers? If so, what elements are considered in framing them and what service do they cover? Are there separate tolls for boats and cargo? Give typical illustrations.

(*b*) What elements enter into the making of towing rates on canals and rivers? Give illustrations of towing charges and send copies of any tariffs or towing rates.

(*c*) Do inland water lines have regular schedules of freight rates and classifications of freight? Are the rates stable or do they vary frequently with traffic exigencies? Give illustrations.

(*d*) How are inland waterway rates affected by—

(1) Distance of haul?
(2) Quantity of commodity offered?
(3) Speed?
(4) Character of commodity?

Give illustrations on important waterways.

(*e*) Do prorating arrangements exist between water lines and railroads, and to what extent? Give illustrations and send copies of joint rail and water tariffs.

(*f*) How do inland water rates affect railroad freight rates? Are railroad freight rates to water competitive points higher than to interior nonwater points of similar distances? Give illustrations.

Compare inland water rates with paralleling railway rates for short and for long distances, giving specific illustrations which shall show whether waterways have greater competitive power in the one case than in the other.

(*g*) What is the general attitude of rail and water lines toward each other? Is there active competition or are there agreements for the division of traffic? Give examples.

(*h*) Is there any legislation regulating the relations between rail and inland waterway systems of transportation? Is there any governmental restriction on the lowering of rail rates in competition with water rates? Give examples.

(*j*) Is it customary for shippers of goods by inland waterways to insure them, or is the risk assumed by the carrier? To what extent does this affect the freight rate? Give examples.

### VII.—WATER-BORNE TRAFFIC.

(*a*) What is the general character of traffic on inland waterways: The principal commodities moved, the proportion and character of traffic moved in different directions, relative importance of package and bulk freight, etc. (This should be answerd specifically for different waterways.)

(*b*) Send official publications giving, for the last ten years, available statistics of vessel movement and traffic carried on inland waterways; also railroad traffic, tonnage, and ton-mileage.

(*c*) Taking important inland water routes, does local traffic or other traffic predominate, and in what general proportion?

(*d*) Give a concise statement of typical conditions of labor which is employed in navigation and in terminal handling, particularly with reference to wages paid.

NOTE.—The above questions were revised by the members of the National Waterways Commission.

## Chapter I.

### RAILWAY RATES IN HOLLAND.

In view of the fact that there is scarcely a village or town in any corner of Holland which can not be reached by a canal, whose freight charges are so low that a railroad could not hope to compete against them, it must indeed have been, as one authority has stated, a bold man who originally proposed to build railways in the country at all. And the difficulties which William I, who was the pioneer in railroad building in Holland, had to contend with, and the opposition thereto of the entire country must have seemed well-nigh insurmountable. But it is not the purpose of this report to deal with the history of railroads in Holland, nor the vicissitudes they underwent before reaching the state of prosperity in which they are to-day. It may, however, be interesting to know that only about 10 per cent of the freight moved in the country is transported by the railways (the other 90 per cent being transported by the waterways) and of the railway receipts those from passengers are only slightly less than those from freight. The total receipts of the two principal railways of the country, which represent 95 per cent of the receipts of all railways in Holland, amounted in the year 1907 to $20,582,802, divided as follows: Passengers, $10,390,896; merchandise, $9,191,328; passenger baggage, $182,508; live stock, $458,682, and miscellaneous, $359,388.

The two principal lines of railways in Holland to which I have referred are the Maatschappy tot Exploitatie van Staatsspoorwegen, which is owned by the Government but operated by a company who pays to the Government an annual rental therefor, and the Hollandsche Yzeren Spoorweg Maatschappy, which is owned by a private company. In addition thereto there are a number of sections of company-owned lines of small importance. The freight and passenger rates which are charged by both companies are the same, these rates being fixed by the minister of waterstaat. They can not be changed except with the consent of the Government.

Through the courtesy of the Hollandsche Yzeren Spoorweg Maatschappy it has been possible to compile the following tables, which will possibly answer the questions propounded in the department's circular. Tables A to F are in answer to questions I and II, and tables 1 to 10 in answer to question III. The rates given therein are applicable to merchandise intended for domestic use as well as to merchandise destined for export. Table G is in answer to question IV, and Table H in answer to questions V and VI.

## QUESTION I.—COAL RATES.

TABLE A.—*Ten examples of freight rates on coal, open cars, in which all coal is transported.*

TRAFFIC WITH GERMANY.

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilometers (220 pounds). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Marks. | U. S. currency. |
| 300 | 187.5 | Gelsenkirchen to Den Helder... | A.[a] | 10 tons per wagon..... | 0.73 | $0.174 |
| | | | B. | 45 tons per wagon..... | .64 | .152 |
| | | | C. | 200 to 300 tons, with 6 trains per week. | .45 | .107 |
| 203 | 126⅞ | Gelsenkirchen to Amsterdam... | A.[a] | 10 tons per wagon..... | .517 | .123 |
| | | | B. | 45 tons per wagon..... | .465 | .111 |
| | | | C. | 200 to 300 tons, with 6 trains per week. | .43 | .103 |
| 115 | 71⅞ | Gelsenkirchen to Zutphen..... | A.[a] | 10 tons per wagon..... | .323 | .077 |
| | | | B. | 45 tons per wagon..... | .319 | .076 |
| | | | C. | 200 to 300 tons..... | .172 | .041 |

[a] Exceptional tariff.

*Remarks and basis of calculation.*—Classes A, B, and C relate only to the quantities shipped. There is a fixed rate of 0.70 mark ($0.166) per ton for loading and unloading charges for freight in class A and a charge of 1 mark ($0.238) for the same service in class B, included in the freight rate. In class C no charge is made for loading or unloading, this being included in the freight rate of 0.45 mark ($0.107) per 100 kilos (220 pounds). The rate per ton per kilometer (⅝ mile) for class A is 0.022 mark ($0.00524); for class B 0.018 mark ($0.0043), and for class C 0.015 mark ($0.0036). Therefore the freight charges on 10 tons of coal shipped from Gelsenkirchen to Den Helder (class A) would be calculated as follows: 300 kilometers (187.5 miles) at 0.022 mark ($0.00524) per kilometer (⅝ mile) is 66 marks ($15.70) plus 7 marks ($1.67) for charges for loading and unloading is 73 marks ($17.37). For 45 tons the freight would be as follows: 300 kilometers (187.5 miles) at 0.018 mark ($0.0043) per kilometer (⅝ mile) is 243 marks ($57.83) plus 45 marks ($10.70) for loading and unloading is 288 marks ($68.54). In class A all freight pays at the rate given up to 350 kilometers (218¾ miles), but after 350 kilometers the rate changes to 0.014 mark ($0.0033) per ton per kilometer. In classes B and C it remains the same. None of these rates have been given to encourage the development of any industry.

INTERNAL TRAFFIC.

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilometers (220 pounds). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Florins. | U. S. currency. |
| 272 | 170 | Hook of Holland to Harlingen.. | A.[a] | 10 tons per wagon..... | 0.276 | $0.111 |
| | | | B. | 50 tons per wagon..... | .251 | .101 |
| 150 | 93¾ | Amsterdam to Winterswyk.... | A.[a] | 10 tons per wagon..... | .20 | .08 |
| | | | B. | 50 tons per wagon..... | .192 | .077 |
| 201 | 125⅝ | Heerlen to Hilversum..... | A.[a] | 10 tons per wagon..... | .241 | .0968 |
| | | | B. | 50 tons per wagon..... | .216 | .0868 |
| 338 | 211¼ | Heerlen to Sneek..... | A.[a] | 10 tons per wagon..... | .309 | .1242 |
| | | | B. | 50 tons per wagon..... | .282 | .1133 |

[a] Special tariff.

*Remarks and basis of calculation.*—A fixed charge of 0.60 florin ($0.241) per ton, which is added to the freight, is made for loading and unloading. The cost of freight per ton per kilometer (⅝ mile) is for the first 100 kilometers (62½ miles) 0.01 florin ($0.004) per kilometer (⅝ mile); for the following 100 kilometers 0.008 florin ($0.003), and for every kilometer above 200, 0.005 florin ($0.002).

TABLE A.—*Ten examples of freight rates on coal, open cars, in which all coal is transported*—Continued.

TRAFFIC WITH BELGIUM.

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilometers (220 pounds). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Francs. | U. S. currency. |
| 343 | 214⅜ | Charleroi to Den Helder | (a) | 10 tons per wagon | 0.693 | $0.1337 |
| | | | | 50 tons per wagon | .593 | .1144 |
| 260 | 162½ | Charleroi to Amsterdam | (a) | 10 tons per wagon | .61 | .1177 |
| | | | | 50 tons per wagon | .51 | .0984 |
| | | | | 10 tons per wagon | .67 | .1293 |
| 320 | 200 | Charleroi to Enschede | (a) | 50 tons per wagon | .57 | .11 |
| | | | | 100 tons per wagon | .48 | .0926 |

a Special tariff.

*Remarks and basis of calculation.*—A fixed charge (included in the rate) of 0.50 franc ($0.0965) per ton is made for loading and unloading; for quantities of 50 to 100 tons a reduction of 1 franc ($0.193) per ton is made on the basis of calculation given hereunder for freight rates, and for 100 tons and upwards a reduction of 1.90 francs ($0.3667) per ton is made. The freight rate is based on the following, according to distance: From 1 to 25 kilometers (⅝ to 15⅝ miles) 0.06 franc ($0.01) per kilometer (⅝ mile) per ton; for the following 26 to 75 kilometers (16⅛ to 46⅞ miles) 0.04 franc ($0.0077) per kilometer (⅝ mile) per ton; for the following 76 to 100 kilometers (47½ to 62½ miles) 0.02 franc ($0.0038) per kilometer per ton; for the following 101 to 350 kilometers (63⅛ to 218¾ miles) 0.01 franc ($0.00193) per kilometer (⅝ mile) per ton. Example: The freight on 10 tons from Charleroi to Den Helder would be per ton:

| | Francs. | |
|---|---|---|
| For the first 25 kilometers (15⅝ miles) | 1.50 | = $0.2895 |
| For the next 50 kilometers (31¼ miles) | 2.00 | = .3860 |
| For the next 25 kilometers (15⅝ miles) | .50 | = .0965 |
| For the last 243 kilometers (151⅞ miles) | 2.43 | = .4690 |
| 343 kilometers (214⅜ miles) | 6.43 | = 1.2410 |
| Charge for loading and unloading | .50 | = .0965 |
| | 6.93 | = 1.3375 |

The rate on 50 to 100 tons would be the same as above, with a reduction of 1 franc ($0.193) per ton, and for 10 tons and upwards with a reduction of 1.90 francs ($0.3667) per ton.

## QUESTION II.—RATES ON IRON ORE, STONE, LUMBER, FERTILIZER, AND GRAIN.

TABLE B.—*Ten examples of freight rates on iron.*

TRAFFIC WITH GERMANY (OPEN CARS).

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilos (220 lbs.). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Marks. | U. S. currency. |
| 265 | 165⅜ | Amsterdam to Friederich Wilhelms-Hutte. | (a) | 10 tons | 0.61 | $0.1451 |
| 248 | 155 | Rotterdam to Dortmund | (a) | do | .58 | .138 |
| 186 | 116¼ | Amsterdam to Oberhausen | (a) | do | .46 | .1094 |

a Exceptional tariff.

*Remarks and basis of calculation.* A fixed charge of 1.20 marks ($0.2856) per ton, which is added to the freight charges, is made for loading and unloading. The freight rates are calculated as follows: From 1 to 50 kilometers (⅝ to 31¼ miles); 0.02 mark ($0.0047) per ton per kilometer. For every additional kilometer 0.018 mark ($0.0043) per ton per kilometer.

TABLE B.—*Ten examples of freight rates on iron*—Continued.

INTERNAL TRAFFIC (OPEN CARS).

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilos (220 lbs.). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Florins. | U. S. currency. |
| 126 | 78⅜ | Ruurlo to Amsterdam | C | 10 tons | 0.23 | $0.0924 |
| 208 | 130 | Ruurlo to Den Helder | C | do | .31 | .1246 |
| 192 | 120 | Roermond to Amsterdam | C | do | .30 | .1206 |
| 294 | 183¾ | Roermond to Sneek | C | do | .40 | .1608 |

*Remarks and basis of calculation.*—A fixed charge of 0.50 florin ($0.201) per ton, which is added to the freight charges, is made for loading and unloading. The freight rates are calculated as follows: From 1 to 50 kilometers (⅝ mile to 31¼ miles) 0.02 florin ($0.008) per ton per kilometer. For every additional kilometer 0.01 florin ($0.004) per ton per kilometer.

TRAFFIC WITH BELGIUM (OPEN CARS).

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilos (220 lbs.). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Francs. | U. S. currency. |
| 343 | 214⅜ | Rotterdam to Sterpenich | (a) | 10 tons | 0.693 | $0.1337 |
| 247 | 154⅜ | Amsterdam to Namen | (a) | do | .597 | .1152 |
| 181 | 113 | Amsterdam to Antwerp | (a) | do | .531 | .1024 |

a Special tariff.

*Remarks and basis of calculation.*—The basis of calculation is the same as the one for coal given in Table A.

TABLE C.—*Eleven examples of freight rates on bricks.*

INTERNAL TRAFFIC (OPEN CARS).

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilos (220 lbs.). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Florins. | U. S. currency. |
| 168 | 105 | Tiel to Den Helder | (a) | 10 tons per wagon | 0.223 | $0.0896 |
| 86 | 53¾ | Tiel to Amsterdam | (a) | do | .1368 | .0549 |
| 43 | 26⅞ | Tiel to Amersfoort | (a) | do | .0809 | .0325 |
| 192 | 120 | Goor to Sneek | (a) | do | .247 | .0992 |
| 205 | 128½ | Goor to Hook of Holland | (a) | do | .26 | .1045 |

a Special tariff.

*Remarks and basis of calculation.*—A fixed charge of 0.25 florin ($0.1005) per ton, which is added to the freight is made for loading and unloading. The freight rates are calculated as follows: For the first 100 kilometers, 0.013 florin ($0.0052) per ton per kilometer. For each additional kilometer, 0.01 florin ($0.004) per ton per kilometer.

TRAFFIC WITH GERMANY (OPEN CARS).

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilos (220 lbs.). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Marks. | U. S. currency. |
| 317 | 198⅛ | Neuwied to Rotterdam | III | 10 tons per wagon | 0.82 | $0.1951 |
| 264 | 165 | Neuwied to Geldermalsen | III | do | .71 | .1689 |
| 223 | 139⅜ | Andernach to Nymegen | III | do | .60 | .1428 |

*Remarks and basis of calculation.*—A fixed rate of 1.20 marks ($0.2856) per ton (added to the freight) is made for loading and unloading. The freight rates are 0.022 mark ($0.0052) per ton per kilometer.

TABLE C.—*Eleven examples of freight rates on bricks*—Continued.

TRAFFIC WITH BELGIUM (OPEN CARS).

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilos (220 lbs). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Francs. | U. S. currency. |
| 342 | 213⅜ | Rochefort to Alkmaar | II | 10 tons | 0.692 | $0.1335 |
| 293 | 183⅛ | Rochefort to Amsterdam | II | do | .642 | .1240 |
| 258 | 161¼ | Rochefort to Rotterdam | II | do | .608 | .1173 |

*Remarks and basis of calculation.*—The basis of calculation is the same as the one for coal given in Table A

TABLE D.—*Eleven examples of freight rates on wood, lumber, etc.*

TRAFFIC WITH GERMANY (OPEN CARS).

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilos (220 pounds). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Marks. | U. S. currency. |
| 264 | 165 | Hagen to The Hague | III.[a] | 10 tons per wagon | 0.91 | $0.2165 |
| 239 | 149⅜ | Hagen to Amsterdam | III.[a] | do | .84 | .1999 |
| 162 | 101¼ | Hagen to Apeldoorn | III.[a] | do | .61 | .1451 |

[a] Special tariff.

*Remarks and basis of calculation.*—A fixed rate of 1.20 marks ($0.2856) per ton (added to the freight) is made for loading and unloading. The freight rates are 0.03 mark ($0.0071) per ton per kilometer (⅜ mile).

INTERNAL TRAFFIC (OPEN CARS).

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilos (220 pounds). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Florins. | U. S. currency. |
| 143 | 89⅜ | Deventer to Alkmaar | A. | 10 tons | 0.25 | $0.1005 |
| 102 | 63½ | Deventer to Amsterdam | A. | do | .21 | .0844 |
| 220 | 137½ | Zaandam to Sittard | A. | do | .32 | .1286 |
| 127 | 79⅜ | Zaandam to Tilburg | A. | do | .23 | .0924 |

*Remarks and basis of calculation.*—A fixed rate of 0.50 florin ($0.201) per ton (added to the freight) is made for loading and unloading. The freight rate is calculated as follows: For the first 50 kilometers (31¼ miles), 0.02 florin ($0.0082) per ton per kilometer (⅜ mile); for each kilometer in addition, 0.01 florin ($0.0041).

TRAFFIC WITH BELGIUM (OPEN CARS).

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilos (220 pounds). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Francs. | U. S. currency. |
| 342 | 213⅜ | Apeldoorn to Chimey | III. | 10 tons | 1.426 | $0.2752 |
| 259 | 161⅞ | Zaandam to Coquelée | III. | do | 1.177 | .2272 |
| 191 | 119⅜ | Zaandam to Antwerp | III. | do | .973 | .1878 |

*Remarks and basis of calculation.*—A fixed rate of 1 franc ($0.193) per ton (added to the freight) is made for loading and unloading. The freight rate is calculated as follows: For the first 75 kilometers (46⅞ miles), 0.06 franc ($0.0115) per ton per kilometer; for the following 76 to 150 kilometers (47½ to 93¾ miles), 0.04 franc ($0.0077) per ton per kilometer, and for every kilometer over 150, 0.03 franc ($0.0058) per ton per kilometer.

TABLE E.—*Eleven examples of freight rates on fertilizers.*

TRAFFIC WITH GERMANY.

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilos (220 pounds). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Marks. | U. S. currency. |
| 438 | 273⅜ | Madgeburg to Apeldoorn | (a) | 10 tons | 0.96 | $0.2285 |
| 547 | 341⅞ | Strassfurt to Amsterdam | (a) | do | 1.12 | .2665 |
| 109 | 68⅛ | Oberhausen to Zutphen | (a) | do | .31 | .0738 |

a Exceptional tariff.

*Remarks and basis of calculation.*—All artificial fertilizers are transported in closed cars. Other kinds in open cars (no difference in rate). A fixed rate of 0.70 mark ($0.1666) per ton (added to the freight) is made for loading and unloading. The cost of freight is 0.022 mark ($0.0052) per ton per kilometer (⅝ miles) for the first 350 kilometers (218¾ miles); for every kilometer in addition 0.014 mark ($0.0033) per ton per kilometer.

INTERNAL TRAFFIC.

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilos (220 pounds). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Florins. | U. S. currency. |
| 143 | 89⅜ | Dordrecht to Hoorn | (a) | 10 tons | b 0.1875 | $0.0754 |
| | | | | | c .25 | .1005 |
| 233 | 145⅝ | Dordrecht to Leeuwarden | (a) | do | b .255 | .1025 |
| | | | | | c .34 | .1367 |
| 271 | 169⅜ | Maastricht to Alkmaar | (a) | do | b .285 | .1146 |
| | | | | | c .38 | .1527 |
| 341 | 213⅛ | Maastricht to Sneek | (a) | do | b .3375 | .1357 |
| | | | | | c .45 | .1809 |

a Special tariff. b Open cars. c Closed cars.

*Remarks and basis of calculation.*—A fixed rate of 0.50 florin ($0.2010) per ton is made for loading and unloading. The cost of freight for closed cars is 0.02 florin ($0.008) per ton per kilometer (⅝ mile) for the first 50 kilometers (31¼ miles); for every additional kilometer 0.01 florin ($0.004) per ton per kilometer. A reduction of 25 per cent is made for open cars.

TRAFFIC WITH BELGIUM (OPEN CARS.)

| Distance. | | Terminals. | Class. | Rate by quantity. | Freight per 100 kilos (220 pounds). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Francs. | U. S. currency. |
| 383 | 239⅜ | Apeldoorn to Sterpereich | I.a | 10 tons | a 0.966 | $0.1864 |
| | | | II.a | do | c .766 | .1478 |
| 217 | 135⅝ | Amsterdam to Brussels | I.a | do | b .795 | .1534 |
| | | | II.a | do | c .567 | .1094 |
| 99 | 61⅞ | Rotterdam to Antwerp | I.a | do | b .472 | .0911 |
| | | | II.a | do | c .448 | .0865 |

a Special tariff. b Artificial fertilizers. c Phosphates.

*Remarks and basis of calculation.*—A fixed rate of 0.50 franc ($0.0965) per ton is made for loading and unloading. The basis of calculation for artificial fertilizers is as follows: For the first 1 to 25 kilometers (⅝ to 15⅝ miles) 0.06 franc ($0.0116) per ton per kilometer; for the following 26 to 75 kilometers (16¼ to 46⅞ miles) 0.04 franc ($0.007) per ton per kilometer; for the following 76 to 150 kilometers (47½ to 93¾ miles) 0.03 franc ($0.007) per ton per kilometer; for the following 151 to 225 kilometers (94⅜ to 140⅝ miles) 0.02 franc ($0.0039) per ton per kilometer; for the following 226 to 350 kilometers (141½ to 218¾ miles) 0.01 franc ($0.0019) per ton per kilometer; for every kilometer (⅝ mile) in addition to 350, 0.02 franc ($0.0039) per ton per kilometer.

TABLE F.—*Eleven examples of freight rates on grain—Closed cars.*

TRAFFIC WITH GERMANY.

| Distance. | | Terminals. | Class. | Rate of quantity. | Freight per 100 kilos (220 pounds). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Marks. | U. S. currency. |
| 587 | 366⅝ | Halle to Amsterdam | (a) | 10 tons | 1.54 | $0.3665 |
| 365 | 228⅛ | Nordhausen to Almelo | (a) | do | 1.05 | .2499 |
| 234 | 146¼ | Andernach to Arnhem | (a) | do | .92 | .2190 |

a Exceptional tariff.

*Remarks and basis of calculations.*—A fixed rate of 0.50 florin ($0.2010) per ton is made for loading and unloading. The freight charges are 0.02 florin ($0.008) per ton per kilometer (⅝ mile) for the first 1 to 50 kilometers (⅝ to 31¼ miles); for every additional kilometer (⅝ mile) 0.01 florin ($0.004) per ton per kilometer.

INTERNAL TRAFFIC.

| Distance. | | Terminals. | Class. | Rate of quantity. | Freight per 100 kilos (220 pounds). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Florins. | U. S. currency. |
| 133 | 83⅛ | Amsterdam to Leeuwarden[b] | (a) | 10 tons | 0.17 | $0.0683 |
| 250 | 156¼ | Sneek to Rosendaal[b] | (a) | do | .28 | .1126 |
| 238 | 148¾ | Amsterdam to Maastricht | (a) | do | .34 | .1367 |
| 107 | 66⅞ | Amsterdam to Tilburg | (a) | do | .21 | .0844 |

a Special tariff.

b This is an old rate fixed by the Government and not changed when the agreement, which was made by both railways in Holland, went into effect.

*Remarks and basis of calculation.*—A fixed rate of 0.50 florin ($0.2010) per ton is made for loading and unloading. The freight charges are 0.02 florin ($0.008) per ton per kilometer (⅝ mile) for the first 50 kilometers (31¼ miles) and 0.01 florin ($0.004) per ton per kilometer for evey kilometer over 50.

TRAFFIC WITH BELGIUM.

| Distance. | | Terminals. | Class. | Rate of quantity. | Freight per 100 kilos (220 pounds). | |
|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | | | Francs. | U. S. currency. |
| 217 | 135⅜ | Amsterdam to Brussels | III | 5 tons | 1.051 | $0.2028 |
| 367 | 229⅜ | The Hague to Sterpenich | III | do | 1.501 | .2897 |
| 401 | 250⅛ | Epe to Sterpenich | III | do | 1.603 | .3094 |

*Remarks and basis of calculation.*—A fixed rate of 1 franc ($0.193) per ton is made for loading and unloading. The freight charges are as follows: For the first 1 to 75 kilometers (⅝ to 46⅝ miles) 0.06 franc ($0.0115) per ton per kilometer; for the following 76 to 150 kilometers (47½ to 93¾ miles) 0.04 franc ($0.0077) per ton per kilometer, and for every kilometer over 150, 0.03 franc ($0.0058) per ton per kilometer.

## QUESTION III. EXPORT RATES.

TABLE 1.—*Special tariff from the harbor stations to all stations in the Netherlands.* (*Rates are per ton.*)

COAL (OPEN CARS).

| | Distance. | | Class A.[a] | | Class B.[b] | |
|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Florins. | U. S. currency. | Florins. | U. S. currency. |
| Amsterdam to— | | | | | | |
| Hengelo | 155 | 96⅞ | 2.04 | $0.82 | 1.94 | $0.78 |
| Almelo | 141 | 88⅛ | 1.93 | .776 | 1.92 | .772 |
| Oldenzaal | 166 | 103¾ | 2.13 | .856 | 2.00 | .804 |
| Enschede | 162 | 101¼ | 2.10 | .844 | 1.98 | .796 |
| Ryssen | 128 | 80 | 1.83 | .736 | | |
| Rotterdam to— | | | | | | |
| Hengelo | 194 | 121½ | 2.36 | .949 | 2.13 | .856 |
| Almelo | 181 | 113⅛ | 2.25 | .904 | 2.07 | .832 |
| Oldenzaal | 205 | 128⅛ | 2.43 | .977 | 2.18 | .876 |
| Enschede | 202 | 126¼ | 2.41 | .969 | 2.17 | .872 |
| Ryssen | 176 | 110 | 2.21 | .888 | 2.04 | .82 |
| Rotterdam-Maas to— | | | | | | |
| Hengelo | 184 | 115 | 2.28 | .916 | 2.08 | .836 |
| Almelo | 171 | 106⅞ | 2.17 | .872 | 2.02 | .812 |
| Oldenzaal | 195 | 121⅞ | 2.36 | .949 | 2.14 | .86 |
| Enschede | 192 | 120 | 2.34 | .941 | 2.12 | .852 |
| Ryssen | 159 | 99⅜ | 2.08 | .836 | 1.96 | .788 |

[a] For a minimum of 10 tons.
[b] For a minimum of 50 tons, and more than 140 kilometers (87½ miles).

*Freight rate per unit (per ton per kilometer).*

| Class A: | Florin. | |
|---|---|---|
| From 1 to 100 kilometers (⅝ to 62½ miles) | 0.01 | =$0.004 |
| From 101 to 200 kilometers (63¼ to 125 miles) | .008 | = .003 |
| From 200 upwards | .005 | = .002 |

Add 0.60 florin ($0.241) per ton for loading and unloading.

TABLE 2.—*Special tariff from Amsterdam and Rotterdam to the Drenthe district.* (*Rates are per ton.*)

RAW COTTON (CLOSED OR COVERED CARS).

| | Distance. | | Class A.[a] | | Class B.[b] | |
|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Florins. | U. S. currency. | Florins. | U. S. currency. |
| Amsterdam to— | | | | | | |
| Almelo | 141 | 88½ | | | | |
| Enschede | 162 | 101¼ | | | | |
| Hengelo | 155 | 96⅞ | 4.70 | $1.889 | 2.80 | $1.126 |
| Oldenzaal | 166 | 103¾ | | | | |
| Ryssen | 128 | 80 | | | | |
| Rotterdam to— | | | | | | |
| Almelo | 181 | 113⅛ | | | | |
| Enschede | 202 | 126¼ | | | | |
| Hengelo | 194 | 121½ | 4.70 | 1.889 | 2.80 | 1.126 |
| Oldenzaal | 205 | 128⅛ | | | | |
| Ryssen | 176 | 110 | | | | |
| Rotterdam-Maas to— | | | | | | |
| Almelo | 171 | 106⅞ | | | | |
| Enschede | 192 | 120 | | | | |
| Hengelo | 184 | 115 | 4.70 | 1.889 | 2.80 | 1.126 |
| Oldenzaal | 195 | 121⅞ | | | | |
| Ryssen | 159 | 99⅜ | | | | |

[a] For quantities less than 5 tons.

[b] For quantities over 5 tons.

TABLE 3.—*Special tariff from Amsterdam, Rotterdam, and Flushing to Maastricht.*

CHINA CLAY (PER TON).

| | Distance. | | Class A (less than 5 tons, in closed cars). | | Class B (from 5 to 10 tons, in open cars). | | Class C (over 10 tons, in open cars). | |
|---|---|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Florins. | U. S. currency. | Florins. | U. S. currency. | Florins. | U. S. currency. |
| Amsterdam to Maastricht | 238 | 148¾ | 5.00<br>*a* 1.92 | $2.01<br>*a*.772 | 3.50 | $1.407 | 3.00 | $1.206 |
| Rotterdam to Maastricht | 230 | 143⅜ | 4.00<br>*a* 1.82 | 1.608<br>*a*.732 | 2.50 | 1.005 | 2.00 | .804 |
| Flushing to Maastricht | 279 | 174⅜ | | | | | 2.32 | .933 |

*a* Special rate for shipper who can show that he shipped 300 tons in 12 successive months.

TABLE 4.—*Special tariff on bulbs from Haarlem in closed cars.*

[The rate is per ton.]

| To— | Distance. | | Freight per case or basket of not less than 200 kilos (440 lbs.). | | Freight per case or basket of 200–300 kilos (440–660 lbs.). | |
|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | *Florins.* | *U. S. currency.* | *Florins.* | *U. S. currency.* |
| Haarlem to Amsterdam | 23 | 14⅜ | 0.30 | $0.1206 | 0.45 | $0.1809 |
| Haarlem to Hook of Holland | 84 | 52½ | .40 | .1608 | .60 | .2412 |
| Haarlem to Rotterdam | 73 | 45⅝ | .40 | .1608 | .60 | .2412 |

TABLE 5.—*Special tariff on straw from Groningen and Almelo.*

[These goods are transported in closed cars if in quantities of less than 5 tons. In larger quantities opens cars are used, which are covered with oilcloth by the shipper. Prices are per ton.]

| | Distance. | | Less than 5 tons. | | 5 to 10 tons. | | 10 tons and over. | |
|---|---|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Florins. | U. S. currency. | Florins. | U. S. currency. | Florins. | U. S. currency. |
| Groningen to Amsterdam | 212 | 132½ | 5.00 | $2.01 | 3.50 | $1.41 | 3.00 | $1.206 |
| Groningen to Rotterdam-Maas | 246 | 153⅝ | 5.50 | 2.211 | 4.00 | 1.608 | 3.50 | 1.407 |
| Almelo to Amsterdam | 141 | 88⅛ | 5.50 | 2.211 | 3.60 | 1.447 | 3.60 | 1.447 |
| Almelo to Rotterdam-Maas | 171 | 106⅞ | 6.20 | 2.492 | 4.00 | 1.608 | 4.00 | 1.608 |

TABLE 6.—*Special tariff on manufactured articles to Rotterdam and Amsterdam.*

CLOSED CARS.

| From— | Distance. | | Less than 5 tons. | | 5 tons and over. | |
|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Florins. | U. S. currency. | Florins. | U. S. currency. |
| Almelo to Rotterdam | 181 | 113⅛ | 6.20 | $2.492 | 5.00 | $2.01 |
| Enschede to Rotterdam | 202 | 126¼ | 6.60 | 2.653 | 5.40 | 2.171 |
| Hengelo to Rotterdam | 194 | 121¼ | 6.40 | 2.573 | 5.20 | 2.09 |
| Oldenzaal to Rotterdam | 205 | 128⅛ | 6.60 | 2.653 | 5.40 | 2.171 |
| Ryssen to Rotterdam | 176 | 110 | 5.90 | 2.372 | 4.70 | 1.889 |
| Tilburg to Rotterdam | 85 | 53⅛ | 3.80 | 1.528 | 2.90 | 1.166 |
| Almelo to Amsterdam | 141 | 88⅛ | 5.50 | 2.211 | 4.30 | 1.729 |
| Enschede to Amsterdam | 162 | 101¼ | 6.00 | 2.412 | 4.80 | 1.929 |
| Hengelo to Amsterdam | 155 | 96⅞ | 5.80 | 2.332 | 4.60 | 1.849 |
| Oldenzaal to Amsterdam | 166 | 103¾ | 6.10 | 2.452 | 4.90 | 1.970 |
| Ryssen to Amsterdam | 128 | 80 | 5.10 | 2.05 | 4.00 | 1.608 |
| Tilburg to Amsterdam | 107 | 66⅞ | 4.50 | 1.809 | 3.50 | 1.407 |

TABLE 7.—*Special tariff for fresh fish from Ymuiden (express freight).*

INTERNAL TRAFFIC. CLOSED CARS (PER TON).

| To— | Distance. | | Ymuiden. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Less than 5 tons. | | 5 to 10 tons. | | 10 tons and over. | |
| | Kilometers. | Miles. | Florins. | U. S. currency. | Florins. | U. S. currency. | Florins. | U. S. currency. |
| INTERNAL TRAFFIC. | | | | | | | | |
| Ymuiden to— | | | | | | | | |
| Amsterdam | 32 | 20 | 4.00 | $1.608 | 3.00 | $1.206 | 3.00 | $1.206 |
| Nymegen | 132 | 82½ | 10.40 | 4.181 | 8.20 | 3.296 | 8.20 | 3.296 |
| Almelo | 173 | 108⅛ | 12.40 | 4.985 | 10.00 | 4.02 | 10.00 | 4.02 |
| TRAFFIC WITH GERMANY. | | | | | | | | |
| Ymuiden to— | | | *Marks.* | | *Marks.* | | *Marks.* | |
| Cologne, Germany | 274 | 171¼ | 20.70 | 4.927 | 15.50 | 3.689 | 14.60 | 3.475 |
| Oberhausen, Germany | 230 | 143⅞ | 18.70 | 4.451 | 13.90 | 3.308 | 13.00 | 3.094 |
| Hanover, Germany | 417 | 260⅝ | 34.40 | 8.187 | 24.70 | 5.879 | 22.90 | 5.45 |
| TRAFFIC WITH BELGIUM.[a] | | | | | | | | |
| Ymuiden to— | | | *Francs.* | | *Francs.* | | *Francs.* | |
| Brussels, Belgium | 218 | 136¼ | 42.40 | 8.183 | 42.40 | 8.183 | 42.40 | 8.183 |

[a] These goods are sent by "Grande Vitesse," which is a quicker service than the ordinary express freight.

TABLE 8.—*Special tariff for cheese from Purmerend.*

CLOSED CARS (PER TON).

| | Distance. | | Less than 5 tons. | | Five tons and over. | |
|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Florins. | United States currency. | Florins. | United States currency. |
| Purmerend to— | | | | | | |
| Amsterdam | 27 | 16¾ | 1.80 | $0.724 | 1.40 | $0.563 |
| Rotterdam | 114 | 71¼ | 4.70 | 1.889 | 3.60 | 1.447 |
| Hook of Holland | 125 | 78⅛ | 5.00 | 2.01 | 3.90 | 1.568 |

TABLE 9.—*Special tariff for spirits from Schiedam.*

CLOSED WAGONS (PER TON).

| | Distance. | | Less than 5 tons. | | Five tons and over. | |
|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Florins. | U. S. currency. | Florins. | U. S. currency. |
| Schiedam to— | | | | | | |
| Amsterdam | 78 | 48⅜ | 3.60 | $1.447 | 2.70 | $1.085 |
| Rotterdam | 13 | 8⅛ | 1.30 | .523 | .90 | .362 |
| Hook of Holland | 24 | 15 | 1.70 | .683 | 1.30 | .523 |

TABLE 10.—*Special tariff for sugar.*

CLOSED CARS.

| | Distance. | | Less than 5 tons. | | 5 tons and over. | |
|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Florins. | U. S. currency. | Florins. | U. S. currency. |
| Arnhem to— | | | | | | |
| Amsterdam | 93 | 58¼ | 4.00 | $1.608 | 3.10 | $1.246 |
| Rotterdam | 119 | 74⅜ | 4.80 | 1.930 | 3.80 | 1.528 |
| Hook of Holland | 152 | 95 | 5.80 | 2.332 | 4.60 | 1.849 |
| Halfweg to— | | | | | | |
| Amsterdam | 15 | 9⅜ | 1.30 | .523 | 1.00 | .402 |
| Rotterdam | 83 | 51⅞ | 3.70 | 1.487 | 2.90 | 1.164 |
| Hook of Holland | 94 | 58¾ | 4.10 | 1.648 | 3.10 | 1.246 |
| Roosendaal to— | | | | | | |
| Amsterdam | 140 | 87½ | 5.40 | 2.171 | 4.30 | 1.729 |
| | | | | | [a] 3.50 | [a] 1.407 |
| Rotterdam | 58 | 36¼ | 3.00 | 1.206 | 2.20 | .884 |
| Hook of Holland | 86 | 53¾ | 3.80 | 1.528 | 2.90 | 1.166 |

[a] Special rate for refined sugar.

## QUESTION IV. RATES FOR HIGHEST GRADE OF CLASSIFIED FREIGHT.

TABLE G.—*Ten examples of freight rates on express goods, closed cars.*

TRAFFIC WITH GERMANY.

| Distance. | | Terminals. | Less than 5 tons, per 100 kilos (220 pounds). | | From 5 to 10 tons, per 100 kilos (220 pounds). | | For 10 tons and over, per 100 kilos (220 pounds). | |
|---|---|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | Marks. | U. S. currency. | Marks. | U. S. currency. | Marks. | U. S. currency. |
| 621 | 388½ | Leipzig to Amsterdam | 10.50 | $2.499 | 7.88 | $1.875 | 7.18 | $1.709 |
| 242 | 151¼ | Cologne to Amsterdam | 3.94 | .937 | 2.90 | .69 | 2.72 | .647 |
| 384 | 240 | Hanover to Amsterdam | 6.66 | 1.585 | 4.70 | 1.119 | 4.34 | 1.033 |
| 119 | 74⅜ | Essen to Zutphen | 2.62 | .624 | 1.84 | .438 | 1.64 | .39 |

*Remarks.*—When a special train is designated for the transport of these goods the prices are doubled.

INTERNAL TRAFFIC.

| Distance. | | Terminals. | Less than 5 tons, per 100 kilos (220 pounds). | | From 5 to 10 tons, per 100 kilos (220 pounds). | | For 10 tons and over, per 100 kilos (220 pounds). | |
|---|---|---|---|---|---|---|---|---|
| Kilometers. | Miles. | | Florins. | U. S. currency. | Florins. | U. S. currency. | Florins. | U. S. currency. |
| 63 | 39⅜ | Amsterdam to The Hague | 0.62 | $0.249 | [a] 0.48 | $0.193 | [c] 0.34 | $0.137 |
| | | | | | [b] .42 | .169 | | |
| 145 | 90⅝ | Rotterdam to Zutphen | 1.12 | .45 | [a] .88 | .354 | [c] .50 | .201 |
| | | | | | [b] .74 | .297 | | |
| 254 | 158⅞ | Rotterdam to Harlingen | 1.56 | .627 | [a] 1.32 | .531 | [c] .72 | .289 |
| | | | | | [b] .96 | .386 | | |

[a] Closed cars. [b] Open cars. [c] Raw material, open cars.

TRAFFIC WITH BELGIUM.

| Distance. | | Terminals. | Less than 5 tons, per 100 kilos (220 pounds). | |
|---|---|---|---|---|
| Kilometers. | Miles. | | Francs. | U. S. currency. |
| 218 | 136⅛ | Amsterdam to Liege | 4.24 | $0.818 |
| 371 | 229⅜ | Amsterdam to Sterpenich | 5.52 | 1.065 |
| 301 | 188⅛ | Amsterdam to Gonoy | 4.91 | .948 |

## QUESTIONS V AND VI.

TABLE H.—*Rates charged in Holland for different distances on typical products included in the various categories of the regular freight classification, showing both carload and less than carload rates, and the rate per ton mile.*

| Distance. | | Per 100 kilos (220 pounds) to 5 tons. | | | | | | Five tons. | | | | Ten tons—Class C.[b] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Express goods. | | General bulky goods. | | Special bulky goods. | | Class A.[a] | | Class B.[b] | | | |
| Kilometers. | Miles. | Florins. | U. S. currency. | Florins. | U. S. currency. | Florins. | U. S. currency. | Florins. | U. S. currency. | Florins. | U. S. currency. | Florins. | U. S. currency. |
| 10 | 6¼ | 0.22 | $0.088 | 0.11 | $0.044 | 0.11 | $0.044 | 0.08 | $0.032 | 0.08 | $0.032 | 0.07 | $0.028 |
| 30 | 18¾ | .38 | .153 | .19 | .076 | .18 | .072 | .14 | .056 | .13 | .052 | .11 | .044 |
| 50 | 31¼ | .54 | .217 | .27 | .108 | .25 | .10 | .20 | .08 | .18 | .072 | .15 | .06 |
| 100 | 62½ | .84 | .338 | .42 | .169 | .37 | .149 | .33 | .133 | .28 | .112 | .20 | .08 |
| 150 | 93¾ | 1.14 | .458 | .57 | .229 | .50 | .201 | .45 | .181 | .38 | .153 | .25 | .10 |
| 200 | 125 | 1.34 | .539 | .67 | .269 | .60 | .241 | .55 | .221 | .43 | .173 | .30 | .121 |
| 250 | 156¼ | 1.54 | .619 | .77 | .309 | .70 | .281 | .65 | .261 | .48 | .193 | .35 | .141 |
| 300 | 187½ | 1.64 | .659 | .82 | .329 | .75 | .301 | .70 | .281 | .53 | .213 | .40 | .161 |
| 350 | 218¾ | 1.74 | .699 | .87 | .35 | .80 | .322 | .75 | .301 | .58 | .233 | .45 | .181 |
| 400 | 250 | 1.84 | .739 | .92 | .37 | .85 | .341 | .80 | .322 | .63 | .253 | .50 | .201 |
| | | | | *c*.70 | *c*.281 | *c*.70 | *c*.281 | *c*.50 | *c*.201 | *c*.50 | *c*.201 | *c*.50 | *c*.021 |

COST OF FREIGHT PER KILOMETER.

| Distance. | | Per 100 kilos (220 pounds) to 5 tons. | | | | Five tons. | | | | Ten tons—Class C.[b] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | General bulky goods. | | Special bulky goods. | | Class A.[a] | | Class B.[b] | | | |
| | | Florins. | U. S. currency. | Florins. | U. S. currency. | Florins. | U. S. currency. | Florins. | U. S. currency. | Florins. | U. S. currency. |
| For the first 50 kilometers (31¼ miles)... | Express rates are double the following: | 0.04 | $0.016 | 0.035 | $0.014 | 0.03 | $0.012 | 0.025 | $0.01 | 0.02 | $0.008 |
| For the next 100 kilometers (62 miles).... | | .03 | .012 | .03 | .012 | .025 | .010 | .020 | .008 | .01 | .004 |
| For the next 100 kilometers (62 miles).... | | .02 | .008 | .02 | .008 | .02 | .008 | .01 | .004 | .01 | .004 |
| For every additional kilometer..... | | .01 | .004 | .01 | .004 | .01 | .004 | .01 | .004 | .01 | .004 |

*a* To Class A belong the goods which are not included in Class B and C, mentioned in part No. 1 of the Dutch Railway Goods Tariff. The classification of the goods is given in Appendix I, page 55. Goods are transported in close cars.

*b* In Class B and C goods are transported in open cars.

*c* Fixed rate per ton, including loading and unloading.

## Chapter II.

### RIVERS AND CANALS IN HOLLAND.

Almost the entire surface of Holland is permeated by a network of canals and rivers. Nowhere else in the world do inland waterways play such an important part in the development of the country. A large part of the canals were originally intended for purposes of drainage, but were afterwards made equally available as a means of transport. From a geological point of view the western half of the country has only recently been formed, and owes its origin almost entirely to the alluvial deposits brought down by the three large rivers—the Rhine, the Meuse, and the Schelde—which find their way through the country to the sea. Of these rivers the Rhine—with its branches, the Yssel and the Waal—is the most important. It is navigable not only throughout its length in Holland, but also from the German frontier to Basle, and great volumes of traffic are borne on its waters from northwest Europe through Holland to the sea, and from thence to all parts of the world. Its length through the Netherlands is 110 miles, that of the Waal 52½ miles, and that of the Yssel 79⅝ miles. The Meuse is 165 miles long, but is not navigable over its entire length, so canals have been dug to extend the traffic between the Provinces through which it flows. These rivers and their branches as they approach the North Sea are connected together in various ways. The Meuse and the Waal join together near the town of Gorinchem under the name of Merwede, and further on part of the stream flows into the Rhine near Rotterdam, and flows through that town under the name of Meuse. The Government, however, is engaged in digging a canal from the Meuse near Bois-le-Duc to the Holländsche Diep (bay), in order to give this river a new mouth and to divide the waters of the Waal and the Meuse. The expenses of this new outlet are estimated at $10,000,000.

The history of many of the canals now in existence in Holland, of which there are upward of 265, dates back to the formation of the country itself, the first one of which there is any record having been dug in 10 B. C. by the Roman general, Claudius Drusus, to connect the Yssel and the Rhine. In the northern Provinces of Groningen and Friesland great peat beds are found. As far back as the fifteenth century the inhabitants discovered the heating qualities of this article, and in order to transport it from the fields to the towns small canals were dug which, from time to time were enlarged. Gradually these canals were extended from one town to another, until now all the towns of the low lands are so connected. From the towns near the sea canals were dug to the seaboard, where harbors were built, notably the one at Delftshaven (now a part of Rotterdam), which was constructed in the fifteenth century.

Many of the canals in the country owe their origin to the fact that as the lakes were drained it became necessary to draw off the superfluous water, and hence canals were made, into which the water forming in the drained "polder" was pumped. The Haarlem Lake, which in 1848 covered a space of 658 square miles, is a notable illustration of this fact.

### I. PUBLIC SUPERVISION.

(*a*) The total length of rivers in Holland is 560 miles. All rivers are under the supervision of the National Government. The total length of canals in the country is about 2,408 miles. These are under the supervision of different authorities as follows:

| | Miles. |
|---|---|
| Under national authority | 342 |
| Under provincial authority | 493 |
| Under private companies | 372 |
| Under local authority | 805 |
| Under national and provincial authority | 114 |
| Under national and private authority | 3 |
| Under national and local authority | 31 |
| Under provincial and private authority | 47 |
| Under provincial and local authority | 117 |
| Under local and private authority | 84 |
| | 2,408 |

(*b*) 1. There is no official control over the capitalization of navigation corporations. The charters of these corporations are given by the Queen, and are never refused unless they contain something conflicting with morality or law. After the royal sanction has been given, it can not be withdrawn. Any violation of the law or of the articles of incorporation renders the directors personally, jointly, and separately liable for any damage which might result therefrom to third persons, and if 75 per cent or more of the capital is lost the corporation is dissolved by force of this fact.

No authority has any power to regulate freight rates on rivers and canals, these being left to individual companies or private individuals.

There are no reports of operation.

The maintenance and improvement of canals is carried on by the National Government in so far as they relate to the most important waterways of the country, but in addition thereto there are a number of waterways maintained by municipalities and private persons. The entrances to the harbors and the canals are maintained and improved by the National Government, but the harbors, docks, and terminal facilities are maintained by the municipality. The only government harbors in the country are those at Delfzyl, Harlingen, Vlieland, Terschelling, Nieuwediep, Wieringen, Medemblik, Urk, Stavoren, Lemmer, Marken Moerdyk, Willemstad, Breskens, the outer harbor of Scheveningen, the outer harbor of Ymuiden, and the fish harbor of Ymuiden.

(*b*) 2. Statistics of water-borne traffic are published every year by the department of waterways, but the class of goods transported is not given. These statistics can not be considered as very accurate, for the reason that they are compiled at the locks or at the tolls as the vessels pass through, and only for the most important ones, no account being taken of the cargoes of the smaller craft.

## II. WATERWAY IMPROVEMENTS.

(*a*) No water power is developed in Holland by works constructed for improving navigation.

(*b*) The river improvements and canal construction in the country, both for the purpose of navigation and drainage, have been carried on by the nation for ages, and are intimately connected with the history of the country itself. The larger part of Holland is several feet below the sea, and a good part of it is below the level of the rivers flowing into it. The engineering problem of keeping the sea out of the country and forcing the rivers out and keeping them within their banks is one that Dutchmen have always had to contend with. The results which they have accomplished would seem to have discouraged anybody but a Dutchman. It has always been the policy of the Government to improve, and to aid in the improvement of, the great waterways communicating with the sea, and the local governments and private individuals have all contributed to this end. In former years Amsterdam was reached from the sea by the Zuiderzee, but in the beginning of the nineteenth century this route became absolutely insufficient, and in 1818 the great North Holland Canal was commenced. It was completed seven years later and used up to the year 1870, when it also became entirely inadequate for the growing commerce of the city. In 1863 a concession for the construction of a direct connection with the North Sea, to take place of the tortuous North Holland Canal, was given to Mr. Jager, which he afterwards transferred to the Amsterdam Canal Company, and on the 8th of March, 1865, one of the greatest canals in the world's history was commenced. It was completed in 1876 and taken over by the Government. The cost of constructing the canal, including the number of improvements made therein up to 1908, was 59,260,000 florins ($23,820,912). The bottom width of the canal is 50 meters (164 feet) and the depth below low water 9.80 meters (32.15 feet). The maximum dimensions of vessels admitted to the canal at present are: Length 220 meters (721.78 feet), breadth 24 meters (78.74 feet), draft 9.20 meters (30.18 feet).

In addition to the North Sea Canal the Government has done a vast amount of work and expended millions of dollars for the purpose of improving water communications with the interior and transportation facilities between Holland and the Rhine provinces in Germany, which would allow merchandise coming from Germany to proceed direct by water to the ports of Holland without transshipment. Between the years 1822 and 1828 a combination of canals known as the "Keulsche Vaart" were improved and locks built for this purpose. These canals were used until 1893, when the Merwede Canal was opened, which shortened and improved the route, and was better for navigation of larger boats. The freight traffic to the Rhine provinces now generally goes by way of Vreeswyk, Arnhem, and Lobith, where it enters Germany, and lighters and barges are towed from Amsterdam and Rotterdam to Mannheim, and even to Basle in Switzerland.

Other canals of minor importance have been dug in the Province of Drenthe principally for the development of the peat industry in that part of the country. These canals have all been built at the expense of the central government, the population of Drenthe being

financially unable to undertake the work. Also a number of other canals have been built in other parts of the country by private enterprise for the purpose above stated. But these canals are all of minor importance and not worthy of consideration.

Where provincial and other authorities were financially unable to improve their canals they were aided by the central government, notably in the case of several canals in South Holland, Groningen, and Friesland.

### III. FLOATING EQUIPMENT.

(*a*) The general character of vessels used on rivers and canals in Holland varies largely according to the class of freight to be carried. Almost all kinds of boats known are utilized, from the small skiffs, propelled by oars, with their freight of fruit and vegetables, plying along the canals of the city, to the large steel barges carrying freight to the Rhine provinces with a capacity of thousands of tons.

1. The greater part of the boats, possibly 90 per cent, plying along the canals in the city, are propelled with oars or long poles, even the largest of them using this means of propulsion, but steam and gasoline are rapidly coming into use, and the time is nearly at hand when all the larger barges will be so propelled.

2. The barges on the Merwede Canal and those plying between Holland and the German Rhine provinces, and the ones running between Amsterdam and Rotterdam, are all towed by tugs which take from three to six barges at a time. The freight over the Zuiderzee, as well as the freight traffic on the Zeeland waterways, is carried in sail boats. For the local traffic in the northern provinces sail boats are used, but they are often towed along the canals by hand or by horse, when there is no wind. Formerly the barges supplying the larger towns with fruit and vegetables and other perishable articles were all towed by hand, but in recent years the steam and gasoline motors have taken their place.

3. The size and draft of vessels varies greatly according to the respective trade in which they may be engaged. On the large rivers and canals between Amsterdam and the Rhine vessels from 200 to 2,500 tons are employed. Two vessels of 3,400 tons were built, but they were not very satisfactory as they were found to be very difficult to handle on the large rivers. The length of the boats used varies from 90 to 300 feet with a draft of from 5.40 to 9 feet when loaded. Boats of 100 to 500 tons are used on the larger canals for transporting internal freight. Their length varies from 55 to 150 feet and their draft from 4.50 to 8.10 feet when loaded. In the northern provinces and the waterways of Zeeland the vessels generally have a capacity of not more than 220 tons with a length of 50 to 100 feet and a draft of 7 feet.

4. Wooden vessels are no longer built, and those still in use are only used in the northern provinces. On the larger canals and on the rivers for international traffic only steel vessels are used.

5. The cost of various types of boats differs according to the size. For sailing vessels up to 100 tons about 60 guilders ($24.12) per ton; from 100 to 120 tons about 55 to 58 guilders ($22.11 to $23.32) per ton; 120 to 150 tons about 52 to 55 guilders ($20.90 to $22.11) per ton; for larger ships from 50 to 52 guilders ($20.10 to $20.90) per ton.

For barges the cost per ton is about as follows:

| | Florins. |
|---|---|
| Up to 200 tons | 45.00 ($18.09) |
| From 200 to 300 tons, about | 43.00 ($17.25) |
| From 300 to 400 tons, about | 40.00 ($16.08) |
| From 400 to 500 tons, about | 37.00 ($14.87) |
| From 500 to 750 tons, about | 34.00 ($13.66) |
| From 750 to 1,000 tons, about | 32.00 ($12.86) |
| From 1,000 to 1,250 tons, about | 30.00 ($12.06) |
| From 1,250 tons and upward, about | 28.00 ($11.26) |

6. Especially long vessels are constructed for use in the traffic on rivers, while for the larger canals shorter vessels are built, as they have to take into consideration the capacity of the locks. The sailing vessels are generally short, so that they can be moved with more ease. For the canals in Friesland vessels can not exceed a maximum length of 98 feet, and on some of the older canals the stationary bridges are so low that special boats have to be constructed to pass under them. No boats are built for any special class of goods, except a few tank ships for the transport of oil and creosote, which is transshipped from Amsterdam and Rotterdam to the interior and to the German Rhine provinces. The wooden vessels in the northern provinces used for the transport of peat are generally built with a small deck fore and aft in order to leave as much space as possible for the deck cargo. All the vessels which have been referred to are, of course, designed for the transport of freight, but in addition thereto there are a number of passenger boats and ferries similar to the engravings found on pages 31 and 64 of a pamphlet entitled "The harbor of Amsterdam," published in 1907 by the chamber of commerce.

7. The number of barges in a fleet rarely exceeds six.

8. The boats are built for low-water stages and invariably are flat bottomed. For the river traffic the normal depth is 8.25 feet; for the larger canals 6.30 feet, and for the smaller ones 5.40 feet.

## IV. OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

(*a*) With the exception of a few small towns, and still smaller corporations there are no canal companies or other waterway improvement companies in Holland, and those referred to do not own and operate vessels.

(*b*) There are only two important cases of consolidation of vessel owners in Holland, viz, the Cooperative Scheppersvereeniging at Amsterdam, which operates about 700 vessels, and the Vereinigte Spediteure und Schiffer at Rotterdam, which owns a fleet of 700. The largest part of the fleet in Holland is operated by small companies, there being no less than 150 separate lines of small steamers going regularly to every part of Holland, and there is not a town or village in the entire country that can not be so reached. In addition thereto there are a large number of individual owners of vessels who operate them themselves and live on the boat with their families.

(*c*) Only three railroads in the country own and operate vessels, viz, the Noord Brabant Duitsche Spoorweg Maatschappy from Boxtel to Wesel, the Maatschappy van Buurtspoorwegen (both of them small companies), and the Hollandsche Yzeren Spoorweg Maatschappy.

The first named has a regular service between Amsterdam and Rotterdam and Vechel, and the second from Rotterdam to Waalwyk. Both lines of boats are operated by the railroads named for the purpose of transshipping their goods to the points specified without having to rely upon other railroad companies, as they have no terminals at the larger cities. The Hollandsche Yzeren Spoorweg Maatschappy operate a line of steamers from Enkhuizen to Stavoren across the Zuiderzee, in order to come in direct communication with their line in Friesland. This fleet consists of 8 passenger boats and 5 freight boats, of which latter 2 are constructed to carry railway cars. In addition thereto the two large railroad companies operating in the country have a few lighters for the transport of goods from sea-going vessels to their loading stations, but a very small portion of the freight coming into the country is transshipped in this way, 90 per cent of it being discharged directly into the barges, which transport it to its destination. The brick works of the country own and operate their own barges for the transport of their product to different parts of the country, and the rice mills for the transport of rice to ocean-going ships. Other companies owning and operating barges are the Grientveen Maatschappy for the transport of moss litter, the Basalt Company for the transport of basalt, and the beet-sugar works to collect the beet root from the surrounding fields.

(*d*) There are no fleets of merchant vessels owned and operated by public authorities, but the Central Government have their own boats for the transport of ammunition, and some of the towns in the country operate their own boats which are used for sanitary purposes.

(*e*) There are no important instances of combinations or monopolies controlling towing on canals and rivers in Holland, the nearest approach thereto being the firm of William H. Müller & Co., of Rotterdam, who have formed a combination of about 300 tugs in the Rhine service for the purpose of keeping up prices, but the results have not been very satisfactory.

## V. TERMINAL FACILITIES.

(*a-b*) Only the principal ports of Amsterdam and Rotterdam and the entrance to the North Sea Canal at Ymuiden show any important features of canal terminals, these being the principal entrances into the country on the seaboard. In order to compete successfully with the large ports of Europe, both Amsterdam and Rotterdam have been compelled to establish and erect the most up-to-date appliances to facilitate the transport of cargoes from the sea-going vessels to the Rhine lighters, and to keep their terminals in the highest order of perfection. The docks of Amsterdam date back only twenty-five years. They consist of the eastern and western docks and the "Y." The first named has an area of 37 acres, and is used only for small craft and sea-going boats with light draft, and the western dock is mainly utilized by vessels from England with merchandise destined for Amsterdam and for transshipment to interior points. The "Y" is a large sheet of water along which the city was built in the olden times, and covers an area of 531 acres, with a length of 5⅛ miles. The most important quay, and the oldest, is the commercial quay,

which divides part of the "Y" and connects with the shore, and along which ocean-going boats to the East Indies are berthed. These ships are of 6,000 tons with a draft of 30.3 feet.

On this quay the large warehouses of the most important bonded companies are situated, in which goods are stowed in bond, and for which warrants are issued. These warehouses have an available space of 108,240 square feet, and in addition thereto, 22 separate rooms for cold storage regulated by ice machines to attain any temperature desired. They cover a space of 17,515 square feet. They are so constructed that goods can be loaded or unloaded to or from any floor into or from the steamer by means of hydraulic cranes, running along the quay. Along both sides of the quay railway tracks have been constructed so that goods may be transferred directly from the cars to the ship and vice versa. On the quays are a number of hydraulic cranes, one with a lifting power of 80 tons and a reach of 24.60 feet; one of 30 tons with a reach of 26.24 feet, and 31 movable hydraulic cranes with a lifting power of from 750 to 6,000 tons and a reach of 27 feet. Parallel to, and at a distance of 738 feet is situated the "Y" quay, with a width of from 1,640 to 3,280 feet. On the western side of this quay four custom-houses have been erected covering a space of 54,920 square feet, and two steamship companies have built sheds thereon in which to store their freight. The western side of the quay is provided with twenty-one 2-ton and ten 6-ton electric portable cranes. As the traffic is continually increasing on the quay the municipality has increased its length by 6,232 feet. The quay is connected with the commercial quay by a dam of sufficient breadth to allow the passage of canal boats. On the eastern side of the quay the Royal Steamship Company has sheds covering a space of 20,467 square feet, and operates 16 cranes with a lifting capacity of from 2 to 30 tons. The railway service has a dock of its own, where the business of the Nieuwe Rynvaart Maatschappy is also conducted. This dock answers to the highest requirements of modern shipping, the most efficient discharging and loading machinery rendering a rapid manipulation of the cargo possible, and its excellent situation near the entrance of the Merwede Canal and the direct connection with the two railway companies afford excellent opportunities for transferring goods direct from sea vessels to truck, van, or Rhine vessel.

In order to execute small repairs, the dock has a repair shop provided with modern machinery driven by electricity, and a workshop for electrical mechanics, and an installation to stamp ores for sampling purposes, which is at the service of the trade. The Ertskade (ore quay) may be looked upon as a continuation of the commercial quay, with a storage space of 21,648 square feet for coals and ores. Six hydraulic cranes with a reach of 48.38 feet are here available. Mostly coal, coke, and ores are discharged here, and the Holland Railway Company has an hydraulic coal tip which can raise 20-ton vans with a gross weight of 30 tons and empty them into the sea vessel. This was erected in connection with the German coals, which come from Germany in trucks. On an average 10 trucks can be dealt with per hour. In the railway dock, 14 movable steam cranes, with a lifting capacity of from 5,000 to 6,000 kilos (13,200 pounds) are available. In this part of the harbor is also the entrepôt dock, originally projected in 1827, but now become too small for the

service for which it was originally intended. As a result the municipality is now engaged in pulling down a part of it and erecting in its place new and up-to-date warehouses, 12 of which are used by the Netherlands Trading Company. Along the Ruyter quay the steamers of the Royal West India Mail service, plying between Amsterdam and New York via the Dutch West Indian colonies, are berthed. The other important docks of Amsterdam, viz, the timber dock and the petroleum dock, are located west of the town. They are both splendidly equipped for the purpose for which they were designed. Along the quays of the "Y" large grain elevators have been erected, from which the grain is conveyed direct from the steamer to the warehouse.

An illustration of all the foregoing will be found in a pamphlet which was issued by the chamber of commerce of Amsterdam, in commemoration of the completion of the North Sea Canal, and which contains an excellent map of the harbor of Amsterdam, showing the different docks and quays referred to; also from a description of the North Sea Canal published by H. Wortman and G. J. van den Broek, both engineers connected with the department of Waterstaat, at the back of which excellent photographs will be found. An interesting and exhaustive description of the North Sea Canal, the Ymuiden Locks, and the port of Amsterdam was published in the "Engineering," of London, in their editions of January 10, 24, February 7, 21, and 28, 1902. It is profusely illustrated with drawings and photographs, and no doubt the information given therein will be of considerable interest and value.

Rotterdam is far ahead of Amsterdam as a seaport, and the municipality has spent vast amounts of money to keep it in the front rank of the seaports of the world, which position it enjoys. It is situated at the mouth of the Rhine and the Meuse, and is the natural seaport for the Rhine provinces, and owes its prominence to its excellent waterway connections not only with the sea but also with Germany, France, and Belgium. All of its important and striking physical features are described in a volume published in English in 1908 by H. A. van Ysselsteyn, deputy director of the department of works at Rotterdam, entitled "The Port of Rotterdam." Its principal quays and harbors are as follows:

Maas Station quay, managed by the Holland Railway Company and used exclusively by ships having direct connection with the railway.

Oosterkade, used by the regular lines between Rotterdam and the places above the town.

Boompjeskade, Willemskade, Westerkade, and Parkkade. Along these quays are berthed the regular lines to England and a few other ports, and partly the Rhine boats, which go up the river to Germany.

Park Harbor, used for the boats to Manchester, Liverpool, Cork, and Hamburg.

Lloyd's quay for the establishments of the Rotterdam Lloyd, a regular service between Rotterdam and the East Indian colonies via Southampton, Marseille, and the Suez Canal.

St. Jobs Harbor, leased to the firm of Wm. H. Müller & Co., for their boats to Grimsby, Spain, and Norway.

In the Schie Harbor the New York and Continental lines have their establishments for their fortnightly service.

On the Noorder Island are the Maas quay and the Prins Hendrik quay; the former is principally used for the island service and the Rhine boats up to Germany, the latter for the boats to Antwerp and Brussels, which go through the island waterways, connecting both countries.

Between the Noorder Island and the south side of the River Meuse are the Nassau and Stieltjes quays, the first one for the Rhine boats and the latter for the steamers going to Hull, Aberdeen, Bilbao, London, etc.

The Wilhelmina quay is the most important one, for the reason that from here the steamers of the Holland-American line leave every week for New York. Formerly they had to share this quay with the Rotterdam Lloyd, but since last year the latter moved to the northern side of the river, so that they have now a quay for their own accommodation.

The Katendrechtsche quay and the Charlois quay, which are both principally used for mooring vessels which can not immediately find a birth in the Maas Harbor.

The St. Janskade and the Kortenoorsche quays are let to the petroleum companies for their use.

On the left side of the Meuse are the principal harbors of the town. These include:

The Binnen Harbor for the copper ore of the Rio-Tinto Company. Part of this harbor is the entrepôt harbor where dutiable goods are stored under supervision of the custom-house officers.

The Spoorweg Harbor, along which are the tracks of the State Railway. Only vessels which discharge goods for immediate transport on the railways use this harbor.

The Rhine Harbor, with a surface of 74 acres and a quay length of 1¼ miles, and in the middle 19 mooring posts for 15 large steamers, which can unload on both sides at the same time into Rhine boats and lighters. On all sides the harbor is inclosed by warehouses which are built by the big "Veems" (warehouse and transport companies) and by private firms. Here the Holland-American Cotton Oil Company has its warehouses.

In the two Katendrecht harbors there is accomodation for boats with heavy goods, such as ore and coals and broken basalt stone. The municipality has here a commercial establishment and the Holland-American Line uses a part for their Rotterdam-Newport News service.

The Maas Harbor, the largest harbor at Rotterdam, with a surface of 143 acres, contains 25 mooring posts for 22 seagoing vessels and has a depth of about 26 feet. Up to the present quays have been constructed in so far as they are required, but not many warehouses have been established. The municipality follows the policy of letting the northern side only for regular lines and the southern side for vessels with heavy cargo, such as timber and coals, for which a quay is not exactly required. Along the northern part railways have been constructed so that transshipment from vessel to truck can be made immediately.

In addition to these harbors Rotterdam is engaged in digging a new one, called the Waal Harbor, with a surface of 61¾ acres, part of which is now being used for Rhine craft and is found to be very useful.

The total surface of all the harbors on both banks is 509 acres, with 25.62 miles of quays. Moreover, the river itself is crowded with vessels, which are discharged in lighters and Rhine boats alongside.

Possibly in no part of the world are the appliances for loading and unloading vessels more advanced than at Rotterdam, and indeed it could not be otherwise with the vast amount and variety of freight which is handled there during the course of a year. It has always been the policy of the municipality and the different steamship and other companies of the city to keep up-to-date appliances for loading and unloading vessels in the most expeditious manner possible. A list of the mechanical appliances used for this purpose in the harbor is given hereunder.

*Steam.*—Thirty-seven cranes of 3,356 pounds capacity, of which 8 are movable; 2 movable cranes of 5,510 pounds; 2 movable cranes of 6,612 pounds; 1 floating crane with a lifting power of 8,816 pounds; 1 with a lifting power of 70,528 pounds; 1 immovable one with a power of 66,120 pounds; and a steam crane of 132,240 pounds. The New Salvage Company owns 3 floating derrick cranes which they rent. The Wilton's Engineering Works possess a floating crane worked by steam with a capacity of 11,000 to 13,224 pounds.

*Hand cranes.*—One hand-worked crane of 4,408 pounds and 1 of 8,816 pounds power.

*Hydraulic cranes.*—One hydraulic crane of 1,650 pounds; 5 hydraulic movable cranes of 3,356 pounds; 4 hydraulic movable cranes of 5,510 pounds; 2 immovable hydraulic cranes of 66,120 pounds; 1 hydraulic immovable crane of 55,100 pounds.

*Electric cranes.*—Three electric cranes of 3,356 pounds; 1 electric crane and 2 electric capstans of 4,408 pounds; 15 electric cranes of 4,959 pounds; 3 electric cranes from 3,310 to 5,510 pounds; 1 electric crane of 6,612 pounds; 3 electric cranes of 6,612 pounds; 7 cranes from 4,959 to 8,816 pounds; 1 crane of 17,632 pounds; 1 coal hoist of 66,120 pounds; 1 electric crane of 110,200 pounds (in construction).

And in addition to the foregoing one lift with a capacity of 48,488 pounds for the purpose of discharging carload lots of coal into vessels, and one coal hoist with a capacity of 68,400 pounds, both hydraulic. On the west side of the second Katendrecht harbor is a crane with a capacity of 21,800 pounds, mounted on a bridge construction, and capable of moving along the quay, which has been fitted with a contrivance for the unloading of basalt.

All of the foregoing facts relate only to the harbors of Amsterdam and Rotterdam, which, as has already been stated, are the principal harbors of the country, but it may not be out of place to make some mention here of the harbor of Ymuiden in connection with the fish industry which is one of the largest of the country.

Ymuiden is situated at the entrance of the North Sea Canal, and is noted for its fishing trade. A special fish harbor and docks have been constructed outside the large locks, and at the entrance of the canal, which allows small fishing smacks to enter at all times and without passing the locks. On the northern side of this dock have been erected two covered fish markets, occupying a total area of 17,712 square feet, and beneath one of these markets a cellar has been constructed for the storage of ice and salt fish in barrels. Both fish markets are connected with the railway. On the south side of the dock

space has been provided for empty vessels to take in stores and coal for the following trip. This side is also provided with loading berths, and one landing stage of concrete, suitable for railway traffic. Behind the loading berths are warehouses, ice factories, and other establishments for the benefit of the fisheries. The harbor was opened in 1896, and since then Ymuiden has become one of the largest fish harbors of the Continent.

(*c*) Railroad tracks are located on all important terminals of inland waterways, permitting direct transfer between railroad and water lines. Such railroad tracks form a belt railroad, connecting all the railroads at a given port. Examples of this are found at Amsterdam, Rotterdam, Flushing, Harlingen, Leeuwarden, Zwolle, Nymegen, Dordrecht, Helmond, and 's Hertogenbosch, the first five named being for international traffic.

(*d*) As all the rivers and the most important canals for international traffic are owned by the Government, the terminals are also owned and controlled by the same authority. A dock, however, is sometimes managed by a railroad company, this privilege being given in order to enable them to transship their freight in a more expeditious manner. Some of the very minor canals and their terminals are owned by private companies, but the traffic thereon is purely local.

The list of dockage fees and other terminal charges are spread over a considerable number of books which are all published in the Dutch language. As a matter of convenience the charges of all the principal harbors are given in Exhibit No. I at the end of this report.

## VI. TOLLS AND FREIGHT RATES.

(*a*) Since the year 1900 the Government has abolished all dues and tolls on rivers and canals under its supervision. On all other canals tolls are charged, but the royal consent has to be given thereto. As a general rule the tolls are very small, and only such sums are collected as are necessary to meet the expense of maintenance, rent, and amortization of the cost of construction. Originally many of the canals which are in existence at the present day were small streams, so that no expense was incurred at the time of starting them other than the expense of improvement. A great number of the canals in Holland were originally built for drainage purposes and only used later on for traffic. It results therefrom that the tolls are very different on the canals of the different companies and provinces, but they are in any case only a nominal sum. They are generally charged according to the length of the canal and the size of vessel. In the Province of Zeeland charges are made according to the nature of the cargo which the vessel carries.

(*b*) Various elements enter into the question of towing rates on canals and rivers. If the towing is done against the current, the rate is higher than if done with the current. A higher rate is also charged in the spring when the streams are swollen by reason of the melting snow in the mountains of Switzerland. If in winter the canals and rivers are jammed with ice, a higher rate is charged, because the towing is more dangerous. The size of the canal and the number of locks to be passed are also taken into consideration.

These different tariffs vary sometimes as much as 100 per cent. There are but few schedules of towing charges published. The rates charged are generally decided upon by the shipper and transport companies, and depend largely upon the demand. From such tariffs as are published the following tables have been compiled, which will give a fair idea of the charges between different points and the fluctuations in charges.

*Fluctuations in freight charges from 4 cents*

RATE AT 4 CENTS PER TON.

| Destination. | Distance. | Tonnage of vessel. 40 to 50. | 50 to 60. | 60 to 70. | 70 to 80. | 80 to 90. | 90 to 100. | 100 to 110. | 110 to 120. | 120 to 140. | 140 to 160. | 160 to 180. | 180 to 200. | 200 to 220. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Miles.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* |
| Lobith | 78 | 15 | 14 | 12 | 11 | 10 | 9 | 9 | 8 | 7 | 7 | 6 | 6 | 5 |
| Emmerich | 84 | 16 | 15 | 14 | 12 | 11 | 11 | 10 | 9 | 9 | 8 | 7 | 7 | 6 |
| Rees-Wesel | 98 | 20 | 19 | 17 | 16 | 14 | 13 | 12 | 11 | 10 | 9 | 9 | 8 | 7 |
| Ruhr-Duisburg | 135 | 24 | 21 | 19 | 17 | 16 | 15 | 13 | 12 | 11 | 10 | 10 | 9 | 9 |
| Uerdingen | 145 | 27 | 25 | 22 | 21 | 18 | 17 | 16 | 15 | 13 | 12 | 11 | 10 | 10 |
| Dusseldorf-Heerdt | 158 | 32 | 27 | 25 | 22 | 21 | 19 | 18 | 17 | 16 | 15 | 13 | 12 | 12 |
| Reisholz-Benrath | 182 | 35 | 31 | 28 | 26 | 24 | 22 | 20 | 19 | 17 | 16 | 15 | 14 | 13 |
| Cologne | 193 | 40 | 37 | 33 | 31 | 28 | 25 | 23 | 21 | 20 | 19 | 17 | 16 | 15 |
| Bonn | 214 | | | | | | | 29 | 27 | 25 | 24 | 23 | 21 | 19 |
| Andernach | 241 | | | | | | | 32 | 30 | 28 | 27 | 25 | 23 | 22 |
| Coblenz | 254 | | | | | | | | | | | | | |

RATE AT 5 CENTS PER TON.

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lobith | 78 | 18 | 17 | 15 | 13 | 12 | 11 | 11 | 10 | 9 | 9 | 8 | 8 | 7 |
| Emmerich | 84 | 21 | 18 | 17 | 15 | 14 | 13 | 12 | 12 | 11 | 10 | 9 | 8 | 8 |
| Rees-Wesel | 98 | 25 | 23 | 21 | 20 | 18 | 16 | 14 | 13 | 12 | 12 | 11 | 10 | 9 |
| Ruhr-Duisburg | 135 | 30 | 27 | 24 | 22 | 20 | 18 | 17 | 15 | 14 | 13 | 12 | 12 | 11 |
| Uerdingen | 145 | 34 | 31 | 28 | 26 | 23 | 22 | 20 | 18 | 16 | 15 | 14 | 13 | 12 |
| Dusseldorf-Heerdt | 158 | 38 | 33 | 31 | 28 | 26 | 24 | 22 | 21 | 20 | 18 | 16 | 16 | 15 |
| Reisholz-Benrath | 182 | 43 | 39 | 35 | 33 | 30 | 27 | 25 | 23 | 22 | 20 | 18 | 18 | 17 |
| Cologne | 193 | 50 | 47 | 40 | 38 | 35 | 32 | 29 | 27 | 25 | 23 | 21 | 20 | 18 |
| Bonn | 214 | | | | | | | 36 | 34 | 32 | 30 | 28 | 27 | 25 |
| Andernach | 241 | | | | | | | 40 | 38 | 35 | 33 | 31 | 29 | 27 |
| Coblenz | 254 | | | | | | | | | | | | | |

RATE AT 6 CENTS PER TON.

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lobith | 78 | 22 | 20 | 18 | 16 | 15 | 14 | 13 | 12 | 11 | 11 | 10 | 10 | 9 |
| Emmerich | 84 | 24 | 22 | 20 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 10 |
| Rees-Wesel | 98 | 30 | 27 | 25 | 23 | 21 | 19 | 17 | 16 | 15 | 14 | 13 | 12 | 11 |
| Ruhr-Duisburg | 135 | 36 | 32 | 29 | 26 | 24 | 22 | 20 | 19 | 18 | 16 | 15 | 14 | 13 |
| Uerdingen | 145 | 41 | 37 | 34 | 31 | 28 | 26 | 24 | 22 | 20 | 18 | 17 | 16 | 15 |
| Dusseldorf-Heerdt | 158 | 46 | 40 | 37 | 34 | 31 | 29 | 27 | 25 | 24 | 22 | 20 | 19 | 18 |
| Reisholz-Benrath | 182 | 52 | 46 | 42 | 39 | 35 | 33 | 30 | 28 | 26 | 24 | 22 | 21 | 20 |
| Cologne | 193 | 60 | 56 | 50 | 46 | 42 | 38 | 35 | 32 | 30 | 28 | 26 | 24 | 22 |
| Bonn | 214 | | | | | | | 43 | 40 | 38 | 36 | 34 | 32 | 29 |
| Andernach | 241 | | | | | | | 48 | 45 | 42 | 40 | 37 | 35 | 33 |
| Coblenz | 254 | | | | | | | | | | | | | |

RATE AT 7 CENTS PER TON.

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lobith | 78 | 23 | 21 | 19 | 17 | 16 | 15 | 14 | 13 | 12 | 12 | 11 | 11 | 10 |
| Emmerich | 84 | 25 | 23 | 21 | 19 | 18 | 17 | 16 | 15 | 14 | 14 | 13 | 12 | 11 |
| Rees-Wesel | 98 | 32 | 29 | 27 | 24 | 23 | 21 | 20 | 18 | 17 | 16 | 15 | 14 | 13 |
| Ruhr-Duisburg | 135 | 39 | 35 | 32 | 29 | 27 | 25 | 23 | 21 | 20 | 18 | 17 | 16 | 16 |
| Uerdingen | 145 | 44 | 40 | 37 | 33 | 30 | 28 | 26 | 24 | 22 | 21 | 20 | 18 | 17 |
| Dusseldorif-Heerdt | 158 | 50 | 45 | 41 | 38 | 35 | 32 | 30 | 28 | 26 | 24 | 23 | 21 | 20 |
| Reisholz-Benrath | 182 | 56 | 51 | 46 | 43 | 40 | 37 | 34 | 33 | 29 | 27 | 25 | 23 | 22 |
| Cologne | 193 | 64 | 59 | 54 | 50 | 46 | 42 | 39 | 36 | 34 | 31 | 29 | 27 | 24 |
| Bonn | 214 | | | | | | | 48 | 45 | 42 | 39 | 37 | 35 | 32 |
| Andernach | 241 | | | | | | | 54 | 50 | 47 | 45 | 42 | 39 | 37 |
| Coblenz | 254 | | | | | | | 58 | 54 | 50 | 46 | 43 | 41 | 39 |

*to 10 cents per ton and length of haul.*

RATE AT 4 CENTS PER TON.

| Tonnage of vessel. | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 220 to 250. | 250 to 280. | 280 to 320. | 320 to 360. | 360 to 400. | 400 to 450. | 450 to 500. | 500 to 550. | 550 to 600. | 600 to 680. | 680 to 700. | 700 to 840. | 840 to 920. | 920 to 1,000. | 1,000 to 1,080. | 1,080 to 1,160. | 1,160 to 1,240. | 1,240 to 1,320. | 1,320 to 1,400. | 1,400 and upward. |
| *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* |
| 5 | | | | | | | | | | | | | | | | | | | |
| 6 | 6 | 5 | | | | | | | | | | | | | | | | | |
| 7 | 7 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | | | | | | |
| 8 | 8 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 |
| 9 | 9 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 | 5 |
| 11 | 10 | 10 | 9 | 9 | 9 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 6 |
| 12 | 12 | 11 | 10 | 10 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 6 |
| 13 | 13 | 12 | 12 | 11 | 10 | 10 | 10 | 9 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 6 |
| 18 | 17 | 15 | 15 | 14 | 13 | 13 | 12 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 10 | 10 | 9 | | |
| 21 | 19 | 18 | 17 | 16 | 15 | 15 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | | |
| | | | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 14 | 14 | 14 | |

RATE AT 5 CENTS PER TON.

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | | | | | | | | | | | | | | | | | | | |
| 7 | 7 | 7 | | | | | | | | | | | | | | | | | |
| 9 | 8 | 8 | 8 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | | | | | | |
| 10 | 10 | 9 | 9 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 6 | 5 | 5 | 5 | 5 |
| 12 | 11 | 11 | 10 | 10 | 9 | 9 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 6 | 6 | 6 | 6 | 6 |
| 14 | 13 | 12 | 12 | 11 | 11 | 10 | 10 | 10 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 |
| 15 | 14 | 13 | 12 | 12 | 12 | 11 | 11 | 10 | 10 | 10 | 10 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 7 |
| 17 | 16 | 15 | 14 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 11 | 10 | 10 | 10 | 9 | 9 | 9 | 8 | 8 |
| 23 | 21 | 19 | 18 | 17 | 17 | 16 | 15 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 12 | 12 | | |
| 26 | 24 | 22 | 20 | 19 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 15 | 15 | 14 | 14 | | |
| | | | 22 | 21 | 20 | 20 | 20 | 19 | 19 | 19 | 19 | 18 | 18 | 18 | 18 | 18 | 18 | 17 | 17 |

RATE AT 6 CENTS PER TON.

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | | | | | | | | | | | | | | | | | | | |
| 9 | 8 | 8 | | | | | | | | | | | | | | | | | |
| 10 | 10 | 10 | 9 | 9 | 9 | 8 | 8 | 7 | 7 | 7 | 7 | 6 | 6 | | | | | | |
| 12 | 12 | 11 | 11 | 10 | 10 | 9 | 9 | 8 | 8 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 6 | 6 | 6 |
| 14 | 13 | 13 | 12 | 12 | 11 | 10 | 10 | 10 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 |
| 17 | 16 | 15 | 14 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 10 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 8 |
| 18 | 17 | 16 | 15 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 10 | 9 | 9 | 9 |
| 21 | 19 | 18 | 17 | 16 | 16 | 15 | 14 | 14 | 14 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 10 | 10 | 10 |
| 27 | 25 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 16 | 15 | 15 | 15 | 15 | 14 | 14 | 14 | | |
| 31 | 29 | 27 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 19 | 19 | 18 | 18 | 18 | 18 | 17 | 17 | | |
| | | | 25 | 25 | 24 | 24 | 23 | 23 | 23 | 22 | 22 | 22 | 22 | 22 | 22 | 21 | 21 | 21 | 21 |

RATE AT 7 CENTS PER TON.

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 9 | 9 | | | | | | | | | | | | | | | | | |
| 11 | 10 | 10 | | | | | | | | | | | | | | | | | |
| 12 | 12 | 11 | 11 | 10 | 10 | 9 | 9 | 8 | 8 | 7 | 7 | 7 | 7 | | | | | | |
| 15 | 14 | 13 | 12 | 11 | 11 | 10 | 10 | 9 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 7 |
| 16 | 16 | 15 | 14 | 13 | 12 | 12 | 11 | 11 | 10 | 10 | 10 | 9 | 9 | 9 | 9 | 9 | 8 | 8 | 8 |
| 19 | 18 | 17 | 16 | 15 | 14 | 14 | 13 | 13 | 12 | 12 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 10 | 9 |
| 21 | 19 | 18 | 17 | 17 | 16 | 16 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 10 |
| 23 | 22 | 21 | 19 | 19 | 18 | 17 | 16 | 15 | 15 | 15 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 11 |
| 30 | 28 | 27 | 25 | 24 | 22 | 21 | 20 | 19 | 18 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 16 | | |
| 35 | 33 | 31 | 29 | 28 | 26 | 25 | 24 | 24 | 23 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 19 | | |
| 37 | 35 | 33 | 32 | 30 | 29 | 28 | 27 | 26 | 25 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 22 | 22 | 22 |

*Fluctuations in freight charges from 4 cents*

RATE AT 8 CENTS PER TON.

| Destination. | Distance. | Tonnage of vessel. 40 to 50. | 50 to 60. | 60 to 70. | 70 to 80. | 80 to 90. | 90 to 100. | 100 to 110. | 110 to 120. | 120 to 140. | 140 to 160. | 160 to 180. | 180 to 200. | 200 to 220. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Miles.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* |
| Lobith | 78 | 24 | 22 | 20 | 18 | 17 | 16 | 15 | 14 | 13 | 13 | 12 | 12 | 11 |
| Emmerich | 84 | 26 | 24 | 22 | 20 | 19 | 18 | 17 | 16 | 15 | 15 | 14 | 13 | 13 |
| Rees-Wesel | 98 | 34 | 31 | 28 | 26 | 25 | 24 | 22 | 20 | 19 | 18 | 17 | 16 | 15 |
| Ruhr-Duisburg | 135 | 42 | 38 | 35 | 32 | 30 | 28 | 26 | 24 | 22 | 21 | 20 | 19 | 18 |
| Uerdingen | 145 | 47 | 44 | 40 | 36 | 33 | 31 | 29 | 27 | 25 | 24 | 23 | 21 | 20 |
| Dusseldorf-Heerdt | 158 | 54 | 50 | 46 | 42 | 39 | 36 | 33 | 31 | 29 | 27 | 26 | 24 | 23 |
| Reisholz-Benrath | 182 | 60 | 55 | 51 | 47 | 43 | 40 | 37 | 35 | 33 | 30 | 28 | 26 | 25 |
| Cologne | 193 | 68 | 62 | 58 | 54 | 50 | 47 | 44 | 41 | 38 | 35 | 32 | 30 | 29 |
| Bonn | 214 | ..... | ..... | ..... | ..... | ..... | ..... | 52 | 49 | 46 | 43 | 40 | 38 | 36 |
| Andernach | 241 | ..... | ..... | ..... | ..... | ..... | ..... | 60 | 56 | 52 | 48 | 46 | 44 | 42 |
| Coblenz | 254 | ..... | ..... | ..... | ..... | ..... | ..... | 64 | 60 | 56 | 51 | 50 | 48 | 46 |

RATE AT 9 CENTS PER TON.

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lobith | 78 | 27 | 25 | 23 | 21 | 19 | 18 | 17 | 16 | 16 | 15 | 14 | 13 | 13 |
| Emmerich | 84 | 29 | 27 | 25 | 23 | 22 | 20 | 19 | 18 | 18 | 16 | 15 | 15 | 15 |
| Rees-Wesel | 98 | 38 | 34 | 31 | 29 | 27 | 25 | 24 | 22 | 20 | 20 | 19 | 18 | 17 |
| Ruhr-Duisburg | 135 | 44 | 40 | 37 | 34 | 32 | 30 | 28 | 26 | 24 | 22 | 21 | 20 | 19 |
| Uerdingen | 145 | 49 | 46 | 42 | 38 | 35 | 33 | 31 | 29 | 27 | 25 | 24 | 22 | 21 |
| Dusseldorf-Heerdt | 158 | 57 | 52 | 48 | 44 | 40 | 38 | 35 | 33 | 31 | 29 | 28 | 26 | 25 |
| Reisholz-Benrath | 182 | 64 | 59 | 54 | 50 | 46 | 43 | 40 | 38 | 35 | 33 | 31 | 29 | 27 |
| Cologne | 193 | 73 | 67 | 62 | 57 | 53 | 50 | 47 | 44 | 41 | 38 | 33 | 33 | 31 |
| Bonn | 214 | ..... | ..... | ..... | ..... | ..... | ..... | 54 | 51 | 48 | 45 | 42 | 40 | 38 |
| Andernach | 241 | ..... | ..... | ..... | ..... | ..... | ..... | 62 | 59 | 54 | 50 | 48 | 46 | 44 |
| Coblenz | 254 | ..... | ..... | ..... | ..... | ..... | ..... | 68 | 63 | 59 | 55 | 52 | 50 | 48 |

RATE AT 10 CENTS PER TON.

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lobith | 78 | 30 | 28 | 26 | 24 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 |
| Emmerich | 84 | 32 | 30 | 28 | 26 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
| Rees-Wesel | 98 | 42 | 38 | 35 | 32 | 29 | 27 | 25 | 23 | 22 | 21 | 20 | 19 | 18 |
| Ruhr-Duisburg | 135 | 46 | 42 | 39 | 36 | 33 | 31 | 29 | 27 | 25 | 23 | 22 | 21 | 20 |
| Uerdingen | 145 | 52 | 48 | 44 | 41 | 36 | 35 | 33 | 31 | 29 | 27 | 25 | 24 | 23 |
| Dusseldorf-Heerdt | 158 | 60 | 55 | 51 | 47 | 43 | 41 | 38 | 36 | 34 | 32 | 30 | 29 | 27 |
| Reisholz-Benrath | 182 | 67 | 62 | 53 | 53 | 49 | 46 | 43 | 40 | 38 | 35 | 33 | 31 | 30 |
| Cologne | 193 | 78 | 72 | 66 | 61 | 56 | 53 | 49 | 46 | 45 | 40 | 38 | 36 | 34 |
| Bonn | 214 | ..... | ..... | ..... | ..... | ..... | ..... | 57 | 54 | 50 | 47 | 44 | 43 | 40 |
| Andernach | 241 | ..... | ..... | ..... | ..... | ..... | ..... | 65 | 62 | 56 | 53 | 50 | 48 | 46 |
| Coblenz | 254 | ..... | ..... | ..... | ..... | ..... | ..... | 73 | 67 | 62 | 59 | 55 | 53 | 50 |

*to 10 cents per ton and length of haul*—Continued.

RATE AT 8 CENTS PER TON.

| Tonnage of vessel. | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 220 to 250. | 250 to 280. | 280 to 320. | 320 to 360. | 360 to 400. | 400 to 450. | 450 to 500. | 500 to 550. | 550 to 600. | 600 to 680. | 680 to 760. | 760 to 840. | 840 to 920. | 920 to 1,000. | 1,000 to 1,080. | 1,080 to 1,160. | 1,160 to 1,240. | 1,240 to 1,320. | 1,320 to 1,400. | 1,400 and upward. |
| *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* |
| 11 | 10 | 10 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 12 | 12 | 11 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 14 | 13 | 13 | 12 | 11 | 10 | 9 | 9 | 8 | 8 | 8 | 7 | 7 | .... | .... | .... | .... | .... | .... | .... |
| 17 | 16 | 15 | 14 | 13 | 12 | 11 | 11 | 10 | 10 | 10 | 10 | 9 | 9 | 9 | 9 | 9 | 8 | 8 | 8 |
| 19 | 18 | 17 | 16 | 15 | 14 | 14 | 13 | 13 | 12 | 11 | 11 | 10 | 10 | 10 | 10 | 10 | 9 | 9 | 9 |
| 22 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 11 |
| 24 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 13 | 12 | 12 | 12 | 12 |
| 27 | 25 | 32 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 |
| 34 | 32 | 31 | 29 | 27 | 25 | 24 | 23 | 22 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | .... | .... |
| 40 | 38 | 36 | 34 | 32 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 22 | 22 | 21 | 21 | .... | .... |
| 44 | 42 | 40 | 38 | 36 | 34 | 32 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 24 | 23 | 23 | 23 | 23 | 23 |

RATE AT 9 CENTS PER TON.

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 11 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 14 | 13 | 12 | 11 | 10 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 10 | 9 | 9 | 9 | 9 | 8 | 8 | .... | .... | .... | .... | .... |
| 18 | 17 | 16 | 15 | 14 | 13 | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 10 | 9 | 9 | 9 |
| 20 | 19 | 18 | 17 | 16 | 15 | 14 | 14 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 11 | 10 | 10 |
| 24 | 22 | 21 | 20 | 18 | 17 | 16 | 15 | 15 | 15 | 14 | 14 | 13 | 13 | 13 | 13 | 13 | 12 | 12 | 12 |
| 26 | 25 | 23 | 22 | 21 | 21 | 18 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 14 | 13 | 13 |
| 30 | 28 | 26 | 25 | 24 | 22 | 21 | 20 | 19 | 18 | 18 | 17 | 17 | 17 | 16 | 16 | 16 | 16 | 15 | 15 |
| 36 | 34 | 32 | 30 | 28 | 26 | 25 | 24 | 23 | 22 | 21 | 21 | 20 | 20 | 20 | 19 | 19 | 19 | .... | .... |
| 42 | 40 | 38 | 36 | 34 | 32 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 23 | 23 | 22 | 22 | .... | .... |
| 46 | 44 | 42 | 40 | 38 | 36 | 34 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 26 | 25 | 25 | 24 | .... | .... |

RATE AT 10 CENTS PER TON.

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | 12 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 15 | 14 | 13 | 12 | 11 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 17 | 16 | 15 | 14 | 13 | 12 | 11 | 11 | 10 | 10 | 10 | 10 | 09 | 09 | .... | .... | .... | .... | .... |
| 19 | 18 | 17 | 16 | 15 | 14 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 11 | 11 | 10 | 10 | 10 |
| 22 | 21 | 20 | 19 | 17 | 16 | 15 | 15 | 14 | 14 | 13 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 12 | 12 |
| 26 | 25 | 23 | 22 | 20 | 19 | 18 | 17 | 16 | 16 | 15 | 15 | 15 | 15 | 14 | 14 | 14 | 14 | 14 | 13 |
| 29 | 27 | 26 | 24 | 23 | 22 | 20 | 19 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 16 | 16 | 15 | 15 | 15 |
| 33 | 31 | 29 | 28 | 27 | 25 | 23 | 22 | 21 | 20 | 20 | 20 | 19 | 19 | 19 | 18 | 18 | 18 | 17 | 17 |
| 38 | 36 | 34 | 32 | 30 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 21 | 21 | 20 | 20 | 20 | .... | .... |
| 44 | 42 | 40 | 38 | 36 | 34 | 32 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 24 | 24 | 23 | 23 | .... | .... |
| 48 | 46 | 44 | 42 | 40 | 38 | 36 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 27 | 26 | 26 | .... | .... |

*Towing rates.*

UPWARD.

| Tonnage. | Rotterdam to Amsterdam (61 miles). | | | | Rotterdam to Vreeswyk (31 miles). | | | | Vreeswyk to Amsterdam (30 miles). | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Wood. | | Iron. | | Wood. | | Iron. | | Wood. | | Iron. | |
| | Loaded. | Empty. | Loaded. | Empty. | Loaded. | Empty. | Loaded. | Empty. | Loaded. | Empty. | Loaded. | Empty. |
| 16 to 20 | $1.61 | $1.21 | $1.33 | $0.96 | $1.16 | $1.12 | $1.12 | $0.96 | $0.80 | $0.64 | $0.68 | $0.48 |
| 21 to 25 | 1.81 | 1.41 | 1.53 | 1.12 | 1.37 | 1.33 | 1.33 | 1.08 | .88 | .70 | .76 | .54 |
| 26 to 30 | 2.01 | 1.61 | 1.73 | 1.28 | 1.57 | 1.53 | 1.53 | 1.20 | .96 | .76 | .84 | .60 |
| 31 to 35 | 2.21 | 1.81 | 1.93 | 1.44 | 1.77 | 1.65 | 1.65 | 1.32 | 1.04 | .82 | .92 | .66 |
| 36 to 40 | 2.41 | 2.01 | 2.13 | 1.60 | 1.93 | 1.77 | 1.77 | 1.44 | 1.12 | .88 | 1.00 | .72 |
| 41 to 45 | 2.61 | 2.21 | 2.33 | 1.77 | 2.09 | 1.89 | 1.89 | 1.56 | 1.20 | .94 | 1.08 | .78 |
| 46 to 50 | 2.81 | 2.41 | 2.53 | 1.93 | 2.25 | 2.01 | 2.01 | 1.68 | 1.28 | 1.00 | 1.14 | .84 |
| 51 to 55 | 3.05 | 2.57 | 2.73 | 2.09 | 2.41 | 2.13 | 2.13 | 1.78 | 1.36 | 1.06 | 1.20 | .90 |
| 56 to 60 | 3.29 | 2.73 | 2.93 | 2.25 | 2.57 | 2.25 | 2.25 | 1.88 | 1.44 | 1.12 | 1.26 | .96 |
| 61 to 65 | 3.53 | 2.89 | 3.14 | 2.41 | 2.73 | 2.37 | 2.37 | 1.98 | 1.52 | 1.16 | 1.32 | 1.02 |
| 66 to 70 | 3.77 | 3.05 | 3.34 | 2.57 | 2.89 | 2.49 | 2.49 | 2.09 | 1.60 | 1.20 | 1.38 | 1.08 |
| 71 to 75 | 4.02 | 3.21 | 3.54 | 2.73 | 3.05 | 2.61 | 2.61 | 2.19 | 1.68 | 1.24 | 1.44 | 1.14 |
| 76 to 80 | 4.26 | 3.37 | 3.74 | 2.89 | 3.21 | 2.73 | 2.73 | 2.29 | 1.76 | 1.28 | 1.50 | 1.20 |
| 81 to 85 | 4.50 | 3.53 | 3.94 | 3.05 | 3.37 | 2.85 | 2.85 | 2.39 | 1.84 | 1.32 | 1.56 | 1.26 |
| 86 to 90 | 4.74 | 3.69 | 4.14 | 3.21 | 3.53 | 2.97 | 2.97 | 2.49 | 1.92 | 1.36 | 1.62 | 1.32 |
| 91 to 95 | 4.98 | 3.85 | 4.34 | 3.37 | 3.70 | 3.09 | 3.09 | 2.59 | 2.01 | 1.40 | 1.68 | 1.38 |
| 96 to 100 | 5.22 | 4.02 | 4.54 | 3.54 | 3.86 | 3.21 | 3.21 | 2.69 | 2.09 | 1.45 | 1.74 | 1.44 |
| 101 to 110 | 5.42 | 4.18 | 4.74 | 3.70 | 4.02 | 3.37 | 3.37 | 2.81 | 2.17 | 1.51 | 1.83 | 1.50 |
| 111 to 120 | 5.65 | 4.34 | 4.94 | 3.86 | 4.18 | 3.53 | 3.53 | 2.93 | 2.25 | 1.57 | 1.91 | 1.56 |
| 121 to 130 | 5.82 | 4.50 | 5.15 | 4.02 | 4.34 | 3.69 | 3.69 | 3.05 | 2.33 | 1.63 | 1.99 | 1.62 |
| 131 to 140 | 6.03 | 4.66 | 5.35 | 4.18 | 4.50 | 3.85 | 3.85 | 3.17 | 2.41 | 1.69 | 2.07 | 1.68 |
| 141 to 150 | 6.23 | 4.82 | 5.55 | 4.34 | 4.66 | 4.02 | 4.02 | 3.29 | 2.49 | 1.74 | 2.15 | 1.74 |
| 151 to 160 | 6.43 | 4.98 | 5.75 | 4.50 | 4.82 | 4.18 | 4.18 | 3.41 | 2.57 | 1.80 | 2.25 | 1.80 |
| 161 to 170 | 6.63 | 5.14 | 5.95 | 4.66 | 4.98 | 4.34 | 4.34 | 3.53 | 2.73 | 1.86 | 2.35 | 1.86 |
| 171 to 180 | 6.83 | 5.30 | 6.15 | 4.82 | 5.14 | 4.50 | 4.50 | 3.65 | 2.81 | 1.92 | 2.45 | 1.92 |
| 181 to 190 | 7.03 | 5.46 | 6.35 | 4.98 | 5.30 | 4.66 | 4.66 | 3.77 | 2.89 | 1.98 | 2.55 | 1.98 |
| 191 to 200 | 7.23 | 5.62 | 6.55 | 5.14 | 5.46 | 4.82 | 4.82 | 3.89 | 2.97 | 2.05 | 2.65 | 2.05 |
| 201 to 220 | 7.64 | 5.94 | 6.87 | 5.42 | 5.74 | 5.06 | 5.06 | 4.02 | 3.13 | 2.19 | 2.75 | 2.15 |
| 221 to 240 | 8.04 | 6.26 | 7.19 | 5.70 | 6.02 | 5.30 | 5.30 | 4.22 | 3.29 | 2.33 | 2.85 | 2.25 |
| 241 to 260 | 8.44 | 6.58 | 7.51 | 5.98 | 6.30 | 5.54 | 5.54 | 4.42 | 3.45 | 2.47 | 2.97 | 2.35 |
| 261 to 280 | 8.84 | 6.90 | 7.83 | 6.27 | 6.59 | 5.78 | 5.78 | 4.62 | 3.61 | 2.61 | 3.09 | 2.45 |
| 281 to 300 | 9.24 | 7.23 | 8.16 | 6.55 | 6.87 | 6.03 | 6.03 | 4.82 | 3.77 | 2.75 | 3.21 | 2.55 |
| 301 to 320 | 9.64 | 7.55 | 8.48 | 6.83 | 7.15 | 6.27 | 6.27 | 5.02 | 3.93 | 2.89 | 3.33 | 2.65 |
| 321 to 340 | 10.05 | 7.87 | 8.80 | 7.11 | 7.43 | 6.51 | 6.51 | 5.22 | 4.10 | 3.03 | 3.45 | 2.75 |
| 341 to 360 | 10.45 | 8.20 | 9.12 | 7.39 | 7.71 | 6.75 | 6.75 | 5.42 | 4.26 | 3.17 | 3.57 | 2.85 |
| 361 to 380 | 10.85 | 8.52 | 9.44 | 7.67 | 7.99 | 6.99 | 6.99 | 5.62 | 4.42 | 3.31 | 3.69 | 2.95 |
| 381 to 400 | 11.25 | 8.84 | 9.76 | 7.95 | 8.28 | 7.23 | 7.23 | 5.82 | 4.58 | 3.45 | 3.81 | 3.05 |
| 401 to 420 | 11.65 | 9.16 | 10.08 | 8.24 | 8.56 | 7.47 | 7.47 | 6.03 | 4.74 | 3.59 | 3.93 | 3.15 |
| 421 to 440 | 12.06 | 9.48 | 10.41 | 8.52 | 8.84 | 7.71 | 7.71 | 6.23 | 4.90 | 3.73 | 4.06 | 3.25 |
| 441 to 460 | 12.46 | 9.80 | 10.73 | 8.80 | 9.12 | 7.95 | 7.95 | 6.43 | 5.06 | 3.88 | 4.18 | 3.35 |
| 461 to 480 | 12.86 | 10.12 | 11.05 | 9.08 | 9.40 | 8.19 | 8.19 | 6.63 | 5.22 | 4.02 | 4.30 | 3.45 |
| 481 to 500 | 13.26 | 10.45 | 11.37 | 9.36 | 9.68 | 8.44 | 8.44 | 6.83 | 5.38 | 4.16 | 4.42 | 3.55 |

DOWNWARD.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 to 20 | $1.33 | $1.12 | $1.21 | $1.12 | $0.96 | $0.80 | $0.68 | $0.48 | $0.80 | $0.64 | $0.68 | $0.48 |
| 21 to 25 | 1.53 | 1.33 | 1.41 | 1.33 | 1.08 | .88 | .76 | .54 | .88 | .70 | .76 | .54 |
| 26 to 30 | 1.73 | 1.53 | 1.61 | 1.53 | 1.20 | .96 | .84 | .60 | .96 | .76 | .84 | .60 |
| 31 to 35 | 1.93 | 1.65 | 1.81 | 1.65 | 1.32 | 1.04 | .92 | .66 | 1.04 | .82 | .92 | .66 |
| 36 to 40 | 2.13 | 1.77 | 2.01 | 1.77 | 1.44 | 1.12 | 1.00 | .72 | 1.12 | .88 | 1.00 | .72 |
| 41 to 45 | 2.33 | 1.89 | 2.21 | 1.89 | 1.56 | 1.20 | 1.08 | .78 | 1.20 | .94 | 1.08 | .78 |
| 46 to 50 | 2.53 | 2.01 | 2.41 | 2.01 | 1.68 | 1.28 | 1.14 | .84 | 1.28 | 1.00 | 1.14 | .84 |
| 51 to 55 | 2.73 | 2.13 | 2.57 | 2.13 | 1.78 | 1.36 | 1.20 | .90 | 1.36 | 1.06 | 1.20 | .90 |
| 56 to 60 | 2.93 | 2.25 | 2.73 | 2.25 | 1.88 | 1.44 | 1.26 | .96 | 1.44 | 1.12 | 1.26 | .96 |
| 61 to 65 | 3.14 | 2.37 | 2.89 | 2.37 | 1.98 | 1.52 | 1.32 | 1.02 | 1.52 | 1.16 | 1.32 | 1.02 |
| 66 to 70 | 3.34 | 2.49 | 3.05 | 2.49 | 2.09 | 1.60 | 1.38 | 1.08 | 1.60 | 1.20 | 1.38 | 1.08 |
| 71 to 75 | 3.54 | 2.61 | 3.21 | 2.61 | 2.19 | 1.68 | 1.44 | 1.14 | 1.68 | 1.24 | 1.44 | 1.14 |
| 76 to 80 | 3.74 | 2.73 | 3.37 | 2.73 | 2.29 | 1.76 | 1.50 | 1.20 | 1.76 | 1.28 | 1.50 | 1.20 |
| 81 to 85 | 3.94 | 2.85 | 3.53 | 2.85 | 2.39 | 1.84 | 1.56 | 1.26 | 1.84 | 1.32 | 1.56 | 1.26 |
| 86 to 90 | 4.14 | 2.97 | 3.69 | 2.97 | 2.49 | 1.92 | 1.62 | 1.32 | 1.92 | 1.36 | 1.62 | 1.32 |
| 91 to 95 | 4.34 | 3.09 | 3.85 | 3.09 | 2.59 | 2.01 | 1.68 | 1.38 | 2.01 | 1.40 | 1.68 | 1.38 |
| 96 to 100 | 4.45 | 3.21 | 4.02 | 3.21 | 2.69 | 2.09 | 1.74 | 1.44 | 2.09 | 1.45 | 1.74 | 1.44 |
| 101 to 110 | 4.74 | 3.37 | 4.18 | 3.37 | 2.81 | 2.17 | 1.83 | 1.50 | 2.17 | 1.51 | 1.83 | 1.50 |
| 111 to 120 | 4.94 | 3.53 | 4.34 | 3.53 | 2.93 | 2.25 | 1.91 | 1.56 | 2.25 | 1.57 | 1.91 | 1.56 |
| 121 to 130 | 5.15 | 3.69 | 4.50 | 3.69 | 3.05 | 2.33 | 1.99 | 1.62 | 2.33 | 1.63 | 1.99 | 1.62 |
| 131 to 140 | 5.35 | 3.85 | 4.66 | 3.85 | 3.17 | 2.41 | 2.07 | 1.68 | 2.41 | 1.69 | 2.07 | 1.68 |
| 141 to 150 | 5.55 | 4.02 | 4.82 | 4.02 | 3.29 | 2.49 | 2.15 | 1.74 | 2.49 | 1.74 | 2.15 | 1.74 |
| 151 to 160 | 5.75 | 4.18 | 4.89 | 4.18 | 3.41 | 2.57 | 2.25 | 1.80 | 2.57 | 1.80 | 2.25 | 1.80 |

*Towing rates*—Continued.

DOWNWARD—Continued.

| Tonnage. | Rotterdam to Amsterdam (61 miles). | | | | Rotterdam to Vreeswyk (31 miles). | | | | Vreeswyk to Amsterdam (30 miles). | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Wood. | | Iron. | | Wood. | | Iron. | | Wood. | | Iron. | |
| | Loaded. | Empty. | Loaded. | Empty. | Loaded. | Empty. | Loaded. | Empty. | Loaded. | Empty. | Loaded. | Empty. |
| 161 to 170 | $5.95 | $4.34 | $5.14 | $4.34 | $3.53 | $2.73 | $2.35 | $1.86 | $2.73 | $1.86 | $2.35 | $1.86 |
| 171 to 180 | 6.15 | 4.50 | 5.30 | 4.50 | 3.65 | 2.81 | 2.45 | 1.92 | 2.81 | 1.92 | 2.45 | 1.92 |
| 181 to 190 | 6.35 | 4.66 | 5.46 | 4.66 | 3.77 | 2.89 | 2.55 | 1.98 | 2.89 | 1.98 | 2.55 | 1.98 |
| 191 to 200 | 6.55 | 4.82 | 5.62 | 4.82 | 3.89 | 2.97 | 2.65 | 2.05 | 2.97 | 2.05 | 2.65 | 2.05 |
| 201 to 220 | 6.87 | 5.06 | 5.94 | 5.06 | 4.02 | 3.13 | 2.75 | 2.15 | 3.13 | 2.19 | 2.75 | 2.15 |
| 221 to 240 | 7.19 | 5.30 | 6.26 | 5.30 | 4.22 | 3.29 | 2.85 | 2.25 | 3.29 | 2.33 | 2.85 | 2.25 |
| 241 to 260 | 7.51 | 5.54 | 6.58 | 5.54 | 4.42 | 3.45 | 2.97 | 2.35 | 3.45 | 2.47 | 2.97 | 2.35 |
| 261 to 280 | 7.83 | 5.78 | 6.90 | 5.78 | 4.62 | 3.61 | 3.09 | 2.45 | 3.61 | 2.61 | 3.09 | 2.45 |
| 281 to 300 | 8.16 | 6.03 | 7.23 | 6.03 | 4.82 | 3.77 | 3.21 | 2.55 | 3.77 | 2.75 | 3.21 | 2.55 |
| 301 to 320 | 8.48 | 6.27 | 7.55 | 6.27 | 5.02 | 3.93 | 3.33 | 2.65 | 3.93 | 2.89 | 3.33 | 2.65 |
| 321 to 340 | 8.80 | 6.51 | 7.87 | 6.51 | 5.22 | 4.10 | 3.45 | 2.75 | 4.10 | 3.03 | 3.45 | 2.75 |
| 341 to 360 | 9.12 | 6.75 | 8.20 | 6.75 | 5.42 | 4.26 | 3.57 | 2.85 | 4.26 | 3.17 | 3.57 | 2.85 |
| 361 to 380 | 9.44 | 6.99 | 8.52 | 6.99 | 5.62 | 4.42 | 3.69 | 2.95 | 4.42 | 3.31 | 3.69 | 2.95 |
| 381 to 400 | 9.76 | 7.23 | 8.84 | 7.23 | 5.82 | 4.58 | 3.81 | 3.05 | 4.58 | 3.45 | 3.81 | 3.05 |
| 401 to 420 | 10.08 | 7.47 | 9.16 | 7.47 | 6.03 | 4.74 | 3.93 | 3.15 | 4.74 | 3.59 | 3.93 | 3.15 |
| 421 to 440 | 10.41 | 7.71 | 9.48 | 7.71 | 6.23 | 4.90 | 4.06 | 3.25 | 4.90 | 3.73 | 4.06 | 3.25 |
| 441 to 460 | 10.73 | 7.95 | 9.80 | 7.95 | 6.43 | 5.06 | 4.18 | 3.35 | 5.06 | 3.88 | 4.18 | 3.35 |
| 461 to 480 | 11.05 | 8.19 | 10.12 | 8.19 | 6.63 | 5.22 | 4.30 | 3.45 | 5.22 | 4.02 | 4.30 | 3.45 |
| 481 to 500 | 11.37 | 8.44 | 10.45 | 8.44 | 6.83 | 5.38 | 4.42 | 3.55 | 5.38 | 4.16 | 4.42 | 3.55 |

*Freights between the most important places of Holland.*

| To— | From Amsterdam. | | | | | From Rotterdam. | | | | | From Groningen. | | | | | Nymegen, Arnhem, Lobith. | | | | | Harlingen. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Distance. | 50 tons. | 100 tons. | 200 tons. | 300 tons. | Distance. | 50 tons. | 100 tons. | 200 tons. | 300 tons. | Distance. | 50 tons. | 100 tons. | 200 tons. | 300 tons. | Distance | 50 tons. | 100 tons. | 200 tons. | 300 tons. | Distance. | 50 tons. | 100 tons. | 200 tons. | 300 tons. |
| | *Miles.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Miles.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Miles.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Miles.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* | *Miles.* | *Cts.* | *Cts.* | *Cts.* | *Cts.* |
| Alkmaar | 24 | 30 | 24 | 20 | 18 | 86 | 40 | 30 | 24 | 22 | 140 | 54 | 48 | 40 | ..... | 116 | 44 | 30 | 28 | 24 | 62 | 40 | 30 | 24 | ..... |
| Almelo | 91 | 70 | 60 | ..... | ..... | 152 | 80 | 70 | ..... | ..... | 125 | 76 | 60 | ..... | ..... | 84 | 56 | 50 | ..... | ..... | 94 | 60 | 56 | ..... | ..... |
| Amersfoort | 28 | 38 | 30 | ..... | ..... | 89 | 50 | 40 | ..... | ..... | 119 | 50 | 44 | ..... | ..... | 129 | 50 | 40 | ..... | ..... | 73 | 40 | 32 | ..... | ..... |
| Amsterdam | ..... | ..... | ..... | ..... | ..... | 61 | 36 | 28 | 24 | 20 | 116 | 50 | 36 | 30 | ..... | 91 | 40 | 28 | 22 | 18 | 66 | 40 | 30 | 24 | ..... |
| Apeldoorn | 70 | 48 | 34 | ..... | ..... | 131 | 56 | 40 | ..... | ..... | 116 | 50 | 40 | ..... | ..... | 46 | 36 | 26 | ..... | ..... | 96 | 48 | 36 | ..... | ..... |
| Arnhem | 77 | 44 | 30 | 26 | 22 | 77 | 40 | 28 | 24 | 20 | 193 | 60 | 50 | 40 | ..... | ..... | ..... | ..... | ..... | ..... | 143 | 50 | 40 | 32 | ..... |
| Breda | 98 | 50 | 40 | 32 | ..... | 51 | 48 | 36 | 30 | ..... | 214 | 70 | 60 | 50 | ..... | 104 | 50 | 36 | 30 | ..... | 164 | 64 | 60 | 50 | ..... |
| Delfzyl | 132 | 56 | 44 | 38 | ..... | 194 | 60 | 50 | 44 | ..... | 17 | 30 | 24 | 20 | ..... | 188 | 60 | 50 | 44 | ..... | 71 | 44 | 36 | 30 | ..... |
| Deventer | 75 | 40 | 32 | 26 | 24 | 107 | 48 | 36 | 28 | 26 | 119 | 50 | 40 | 34 | ..... | 51 | 40 | 30 | 24 | 20 | 86 | 50 | 32 | 26 | 24 |
| Dokkum | 99 | 44 | 36 | 30 | ..... | 160 | 60 | 40 | 36 | ..... | 33 | 40 | 30 | ..... | ..... | 155 | 60 | 44 | 36 | ..... | 33 | 36 | 28 | 22 | ..... |
| Dordrecht | 59 | 36 | 28 | 24 | 20 | 12 | 32 | 24 | 20 | 16 | 175 | 60 | 50 | 40 | ..... | 65 | 40 | 28 | 22 | 18 | 124 | 60 | 40 | 30 | ..... |
| Eindhoven | 100 | 80 | 60 | ..... | ..... | 82 | 76 | 60 | ..... | ..... | 215 | 100 | 80 | ..... | ..... | 89 | 80 | 56 | ..... | ..... | 166 | 100 | 72 | ..... | ..... |
| Enkhuizen | 31 | 36 | 26 | 22 | ..... | 93 | 50 | 36 | 28 | ..... | 83 | 50 | 40 | 32 | ..... | 114 | 52 | 40 | 30 | ..... | 34 | 36 | 28 | 24 | ..... |
| The Hague | 39 | 40 | 30 | ..... | ..... | 17 | 36 | 26 | 22 | 18 | 155 | 60 | 50 | ..... | ..... | 95 | 50 | 36 | 30 | 26 | 105 | 60 | 40 | ..... | ..... |
| Groningen | 115 | 52 | 36 | 32 | ..... | 176 | 60 | 40 | 36 | ..... | ..... | ..... | ..... | ..... | ..... | 171 | 60 | 48 | 42 | ..... | 54 | 40 | 72 | 28 | ..... |
| Harlingen | 66 | 40 | 30 | 24 | ..... | 132 | 56 | 36 | 30 | 26 | 54 | 44 | 36 | 32 | ..... | 138 | 60 | 40 | 32 | 28 | ..... | ..... | ..... | ..... | ..... |
| Helmond | 89 | 60 | 40 | 30 | 24 | 72 | 52 | 34 | 28 | 22 | 205 | 92 | 72 | 56 | ..... | 79 | 60 | 40 | 30 | 26 | 155 | 92 | 64 | 40 | ..... |
| 'sHertogenbosch | 66 | 50 | 30 | 24 | 20 | 48 | 44 | 28 | 24 | 20 | 181 | 80 | 62 | 46 | ..... | 55 | 52 | 32 | 24 | 22 | 132 | 84 | 56 | 32 | ..... |
| Kampen | 43 | 40 | 28 | 22 | 20 | 104 | 48 | 34 | 28 | 24 | 88 | 48 | 34 | 28 | ..... | 83 | 40 | 28 | 24 | 20 | 55 | 40 | 30 | 22 | 20 |
| Leeuwarden | 138 | 44 | 36 | 30 | ..... | 147 | 56 | 40 | 34 | ..... | 36 | 40 | 30 | ..... | ..... | 144 | 60 | 44 | 34 | ..... | 18 | 30 | 24 | 20 | ..... |
| Maastricht | 140 | 120 | 70 | 50 | 40 | 122 | 110 | 64 | 46 | 38 | 255 | 120 | 92 | 80 | ..... | 129 | 90 | 64 | 58 | 50 | 206 | 110 | 84 | 70 | 54 |
| Meppel | 60 | 40 | 28 | 24 | 20 | 121 | 48 | 34 | 28 | 26 | 97 | 56 | 40 | 36 | ..... | 89 | 48 | 34 | 28 | 24 | 62 | 46 | 30 | 22 | 20 |
| Middelburg | 125 | 80 | 56 | 40 | 32 | 79 | 60 | 40 | 30 | 24 | 241 | 100 | 60 | 44 | ..... | 137 | 80 | 50 | 32 | 26 | 191 | 100 | 70 | 40 | 30 |
| Nymegen | 89 | 44 | 30 | 26 | 22 | 77 | 40 | 28 | 24 | 20 | 193 | 60 | 50 | 40 | ..... | ..... | ..... | ..... | ..... | ..... | 143 | 50 | 40 | 32 | ..... |
| Rotterdam | 61 | 36 | 28 | 24 | 20 | ..... | ..... | ..... | ..... | ..... | 176 | 60 | 40 | 30 | ..... | 78 | 40 | 28 | 22 | 18 | 127 | 60 | 38 | 28 | 26 |
| Schiedam | 66 | 40 | 32 | 26 | 22 | 5 | 30 | 22 | 20 | 18 | 181 | 60 | 40 | 30 | ..... | 83 | 44 | 30 | 24 | 20 | 212 | 60 | 38 | 28 | 26 |
| Stadskanaal | 145 | 100 | 80 | ..... | ..... | 206 | 100 | 76 | ..... | ..... | 30 | 40 | 30 | ..... | ..... | 201 | 80 | 70 | ..... | ..... | 84 | 56 | 40 | ..... | ..... |
| Terneuzen | 131 | 90 | 60 | 40 | ..... | 75 | 68 | 44 | 32 | 24 | 247 | 100 | 60 | 44 | ..... | 134 | 88 | 50 | 32 | 26 | 197 | 100 | 70 | 40 | 30 |
| Utrecht | 24 | 30 | 24 | 20 | 18 | 37 | 34 | 28 | 24 | 20 | 139 | 50 | 36 | 30 | ..... | 67 | 40 | 28 | 22 | 18 | 89 | 48 | 30 | 24 | ..... |
| Veendam | 134 | 92 | 80 | ..... | ..... | 193 | 92 | 76 | ..... | ..... | 19 | 40 | 28 | ..... | ..... | 189 | 80 | 70 | ..... | ..... | 73 | 56 | 40 | ..... | ..... |
| Vlissingen | 130 | 80 | 56 | 40 | 32 | 84 | 60 | 40 | 30 | 24 | 246 | 100 | 60 | 44 | ..... | 142 | 80 | 50 | 32 | 26 | 196 | 100 | 70 | 40 | 30 |
| Zaandam | 6 | 40 | 40 | 36 | 32 | 67 | 40 | 30 | 26 | 22 | 122 | 50 | 36 | 30 | ..... | 97 | 40 | 30 | 24 | 22 | 72 | 40 | 30 | 24 | ..... |
| Zutphen | 86 | 44 | 36 | 30 | 28 | 117 | 48 | 36 | 28 | 26 | 130 | 50 | 40 | 34 | ..... | 51 | 40 | 30 | 24 | 20 | 86 | 50 | 32 | 26 | 24 |
| Zwolle | 55 | 40 | 28 | 22 | 20 | 104 | 48 | 34 | 28 | 24 | 88 | 48 | 34 | 28 | ..... | 83 | 40 | 28 | 24 | 20 | 55 | 40 | 30 | 22 | 20 |

(*c*) Inland water lines have no regular schedules of freight rates. The rates charged are not stable, as will be seen in the answer to subdivision (*b*) of the preceding question, from which it will be observed that they vary as much as 100 per cent, according to the existing conditions of water and weather. The question of supply and demand also enters largely into the question. The houses engaged in large transport operations usually make yearly contracts with transport companies, and in these instances the freight charges do not fluctuate to any great extent. This is principally in reference to the transport of coal and ores between Amsterdam and Rotterdam and the German Rhine provinces. The value of goods has little influence on the rates.

(*d*) 1. The rates are affected by the distance of haul and other conditions of weather and water, as will appear from the tables given above, but they are far more affected by the possibility of obtaining return freight from the place to which the shipment has been made. A freight rate, for instance, from Ruhrort in Germany to Tiel in Holland on the Waal will be higher than from Ruhrort to Amsterdam or Rotterdam, for the reason that there would be a positive assurance of obtaining a return cargo from the two last-named places, whereas from Tiel, which is a small town, the possibilities are that no return cargo would be secured. For the same reason freight rates from Rotterdam to Wesel in Germany would be higher than from Rotterdam to Ruhrort, notwithstanding the fact that the distance to Ruhrort is greater than the distance to Wesel. Other conditions affecting water rates are the facility of passing certain rivers and canals, the depth of water and the number of tolls to be passed, and whether ice has to be contended with.

2. The quantity of commodity offered has some effect on rates. If a vessel of 1,000 tons capacity does not get a full cargo the rate for a full cargo is charged, nevertheless.

3. No extra charges are made for speed, but it is often stipulated in the contract that a premium will be given if the cargo reaches its destination at a specified time. It is also sometimes stipulated that no freight will be paid unless the merchandise reaches its destination at the time agreed upon, accidents and other causes over which the shipping company have no control being, of course, taken into consideration in the determination of the delay.

4. The character of commodity comprises practically every article of trade.

(*e*) No prorating arrangements exist between water lines and railroads in Holland.

(*f*) Inland water rates have the effect of keeping railroad freight rates down to the lowest possible point where a bare profit can be made. But to say that the effect which the waterways of Holland have on railway freight rates would be duplicated in any country where waterways are improved is not altogether true, for the conditions existing in Holland are entirely different from those existing in any other country. An authority (Edwin A. Pratt), writing upon the subject, says:

> Holland, as every one knows, is a land of waterways. On the one hand there are the great rivers which form channels of communication with Germany, Belgium, and the countries beyond, rivers on whose broad expanses great volumes of traffic pass between northwest Europe and the uttermost parts of the earth, without touching the railway at all. On the other hand, the physical conditions of Holland have led to the whole country being permeated by a network of canals, a large proportion of

which, though intended primarily for purposes of drainage, are equally available as a most effective means of transport. Long before railways were created, the rivers passing through Holland carried transit merchandise at rates with which it seemed impossible that any other mode of conveyance could compete; and though to-day the country is well supplied with railways, over 90 per cent of the sum total of the goods traffic still goes by water. Between Amsterdam and Rotterdam there are boats which leave either place at 8 in the evening, pass along the canals at night, and deliver their consignments the next morning. The railways themselves could not hope to do any better, and, with their much heavier expenses, they can not compete with the waterways for local traffic such as this. The Cooperative Fruit Growers' Association at Beverwyk has two steamers of its own, and these in the season make two, three, or even four journeys a day along the canals to take the fruit to the Amsterdam markets, 15 miles away.

In Friesland after the dairy maids have milked the cow they put the churns in a boat and row off with them to the central butter-making factory of their district. A man removing his household effects from one house or from one part of Holland to another would not dream either of hiring a furniture van or of patronizing the railway. Wherever he lived he would be within easy reach of a canal, and he would find it an easy matter to get his furniture carried to a boat in which it could be conveyed to within what would again be convenient carrying distance of his new home. Such conditions as these affect almost every phase of business and social life in Holland in regard to matters of transport, and in the circumstances it is not at all surprising that the railways should scarcely get 10 per cent of the goods traffic. They would probably have still less but for the fact that they keep their rates down—and necessarily so—to the lowest point on which a bare profit can be made. There are, however, certain considerations which tell in their favor and help them to secure a modest dividend: (1) They can offer what is in most cases a quicker service, a matter of special importance in the case of urgent goods or perishables; (2) they handle a good deal of international traffic, the rivers notwithstanding; and (3) the freezing over of the waterways in severe winters drives on to the railways a large amount of business which they would not otherwise get—if not, indeed, a great deal more than they can manage.

The railway has in one instance to the knowledge of this office reduced its rate of transport to a point where the water lines could not compete. Formerly a large amount of grain was transported by water from Rotterdam to Deventer on the Yssel, and from thence distributed to smaller places in the neighborhood, but the railway decided to transport direct to the places referred to, and reduced their rate to these places $1.20 per car-load lot below the rate charged by the water lines, with the result that they have now most of the business. This is only one isolated case. No other exists. All railway freights in Holland are reckoned according to distance, and are not higher to water-competitive points than to interior non-water points of similar distance. The following shows a comparison between inland water rates with paralleling railway rates for short and long distances. It should be stated, however, that the railway rates do not fluctuate, while the water rates are largely influenced by weather conditions affecting navigation, and also by the quantity transported, as will appear from tables which have been given, heretofore in this report, from which a fluctuation of from 4 cents to 10 cents per ton will be observed. The figures given hereunder are for normal conditions.

The rates per ton between Rotterdam and Ruhrort, a distance of 135 miles, are:

| | By water. | By rail. |
|---|---|---|
| For coal, ore, iron, etc | $0.11 to $0.12 | $1.30 |
| For cereals and timber | .20 | 2.00 |
| For general merchandise | .36 to .72 | 3.34 |

The rates between Amsterdam and Rotterdam, a distance of 61 miles, are by rail $0.402 per ton plus $0.241 for loading and unloading; by water $0.144 per ton for 50 tons; $0.08 for 300 tons and over.

It will be seen from the foregoing how impossible it would be for the railways to compete with the waterways.

(*g*) It can not be said that there is active competition between the railways and the waterways, and there are no agreements between them for the division of traffic. It has already been shown that the railways only get 10 per cent of the entire traffic of the country, and it could not be otherwise in view of the difference between the rates, and they would not get this proportion were it not for the fact that often during severe winters traffic on the canals is practically at a standstill, due to the fact of their being ice bound. In such cases the railways are unable to transport all the freight offered, and the dependence of the country on the waterways is well illustrated at such times by the masses of freight piled up on the quays of Amsterdam and Rotterdam, which the railways are unable to move. At times of prolonged frost large amounts are lost by waterway companies who are unable to carry out their contracts for delivery of coal and ores to the Rhine provinces.

(*h*) There is no legislation regulating the relations between rail and inland-water rates. There is no restriction on the lowering of rail rates in competition with water rates, but as the rail rates are fixed by the Government they could not be lowered except by royal consent, which would no doubt be accorded if application was made therefor, but of this there is no possibility as the rates now are about as low as would enable the railroad to pay for their operating expenses and provide for a small dividend.

(*j*) It is customary for shippers of goods by inland waterways to insure them, but the risk is sometimes assumed by the carrier when yearly contracts are made, the amount of the insurance being added to the amount of the contract.

## VII. WATER-BORNE TRAFFIC.

(*a*) All kinds of goods are transported along the waterways of Holland, the principal commodities moved being grain, English coal, ores, and wood. These are transshipped from seagoing vessels to barges which transport them to interior towns and to Germany. German coal and basalt is largely shipped from Germany to Amsterdam and Rotterdam for transshipment to other countries, and also to interior cities of Holland for local consumption.

(*b*) All official publications obtainable are transmitted herewith.

(*c*) There are no statistics available showing the volume of local traffic along the waterways of Holland, but according to an authority this traffic exceeds many times our "international" traffic. As an illustration of the magnitude of the Rhine traffic with Holland, the Rotterdam Chamber of Commerce in its report for 1908 states that this traffic amounted to over 16,000,000 tons, of which four-fifths went directly to Rotterdam.

Rhine trade between Amsterdam-Rotterdam and Germany for the past ten years.

| Year. | Amsterdam. | Rotterdam. |
|---|---|---|
| | *Tons.* | *Tons.* |
| 1899 | 504,809 | 6,867,164 |
| 1900 | 446,837 | 7,845,544 |
| 1901 | 435,836 | 7,735,307 |
| 1902 | 451,936 | 8,197,989 |
| 1903 | 437,730 | 10,338,291 |
| 1904 | 428,859 | 10,684,261 |
| 1905 | 478,320 | 12,771,307 |
| 1906 | 538,945 | 13,357,575 |
| 1907 | 597,518 | 15,762,526 |
| 1908 | 716,035 | 12,938,898 |

(*d*) Replete as is the literature of Holland in statistics of almost every description, it seems strange that there should be no statistics published with reference to the conditions of labor and the laboring classes. This subject was fully treated in a report made by this office, under instructions from the department, on November 3, 1908 and the information therein given was obtained from investigation by this office. All mechanical labor in Holland is paid by the hour, and the majority of laborers do not earn in excess of $240 per annum. The average wage paid to a laborer employed in terminal handling is $0.06 to $0.07 per hour. The captains of the boats receive from $20 to $25 per month. A large number of the barges are owned by the skipper himself, and generally at the stern of the boat is constructed a small cabin in which the skipper and his family live. The cabin is divided into two or three sections, according to the size of the barge, containing one or two bedrooms and a combination kitchen and sitting room. It is their home and they know no other.

HENRY H. MORGAN, *Consul.*

AMSTERDAM, *December 18, 1909.*

## Exhibit I.

### LIST OF DOCKAGE FEES AND OTHER TERMINAL CHARGES FOR ALL THE PORTS OF HOLLAND.

*Amsterdam.*

*Harbor dues.*—One cent per ton and voyage valid for one month; season ticket per year for sailing barges 20 cents per ton, for steamboats 32 cents per ton. If the vessels have a regular landing place this price is augmented by one-third. Rhine vessels which enter or depart empty get their dues refunded. In time of frost a receipt for dues remains valid for longer than above stated.

*Lock dues.*—For vessels under 40 tons, one-fifth of a cent per ton. For vessels of greater tonnage, two-fifths of a cent per ton, with a minimum of 2 cents per vessel.

*Arnhem.*

*Harbor dues.*—One and four-tenths cents per square meter and per voyage; if stay not interrupted valid for two months. For longer stay, if not forced to remain by frost, half tariff per month. Yearly tickets double the charge for two months.

*Quay dues.*—Two-fifths of a cent per ton and per voyage, valid for seven days for ships under 100 tons; for larger vessel, seventeen days. Yearly tickets for sailing vessels, 4 cents; for steamships, 8 cents per ton.

*Delft.*

*Harbor dues.*—Vessels up to 10 tons, 4 cents per vessel up to 45 tons; for every additional ton four-fifths of a cent up to 70 tons; for every additional ton, 1¼ cents. For larger vessels, 0.32 cent per ton. Yearly tickets are good for 100 voyages. Vessels in transit and not remaining more than twenty-four hours, one-sixth of a cent per ton.

*Delfzyl.*

*Harbor dues.*—None, as the harbor is Government property.

*Lock dues.*—Varying from four-fifths of a cent to 4 cents per ton.

*Deventer.*

*Harbor dues.*—Only dues are levied on boats which remain over for the winter months of December, January, and February, 1.2 cents per ton.

*Quay dues.*—For vessels loading or unloading for the first twenty-four hours, one-sixth of a cent per ton. Vessels not loading or unloading free during the first twelve hours. Afterwards for the first week, one-sixth of a cent per ton, then 0.6 cent per ton.

*Lock dues.*—For vessels with moss litter, peat, and iron ore, 0.8 cent per ton; other loaded vessels, 0.6 cent per ton; empty vessels, 0.4 cent per ton.

*Dordrecht.*

*Harbor dues.*—For steam vessels, 1 cent per ton; for sailing vessels, 0.8 cent per ton, valid for thirty days. For longer stay, half tariff, to be continued every thirty days. Yearly tickets for sailing vessels, 4 cents per ton; for steamships, 12 cents per ton.

*Bridge dues.*—Vessels under 50 tons, 2 cents; from 51 to 100 tons, 4 cents; from 101 to 200 tons, 6 cents; from 201 to 300 tons, 12 cents. Over 300 tons, for every 100 tons or fraction, 2 cents surlpus. Double tariff by night.

*Gouda.*

*Lock dues.*—None.

*Bridge dues.*—None.

*Quay dues.*—Six-tenths cent per ton, valid for fifteen days.

*Gorinchem.*

*Harbor dues.*—None.
*Lock dues.*—None.
*Bridge dues.*—None.
*Quay dues.*—For loading or unloading for vesels up to 100 tons, 0.4 cent per ton. For larger ships, 0.2 cent for every additional ton, valid one month.

*The Hague.*

*Harbor dues.*—One and two-tenths cents per ton, valid for fourteen days.

*Groningen.*

*Harbor dues.*—For vessels in transit, 0.2 cent per ton, with a minimum of 4 cents; for a stay of twenty-four hours, not including Sundays and holidays, three times this amount. If the stay is longer than three weeks the same dues are collected. . Vessels which load or unload pay 0.6 cent per ton. Tugs are free of dues and steam or motor boats pay one and one-half times the tariff.
*Lock dues.*—Four-tenths cent per ton; for one lock an extra fee of 4 cents per vessel.
*Bridge dues.*—None.

*Haarlem.*

*Harbor dues.*—Eight-tenths cent per ton. Tugs under 60 tons and vessels under 13 tons are free.
*Bridge dues.*—Four cents per bridge.

*Hansweert.*

No dues either for locks, bridges, or canals. All is government property.

*Harlingen.*

*Harbor dues.*—Steamboats under 50 tons, 20 cents per vessel. Steamboats more than 50 tons, 30 cents per vessel. Sailing vessels and all others under 100 tons, 0.4 cent. Vessels from 100 to 199 tons, per ton, 0.6 cent; vessels from 200 to 499 tons, per ton, 0.8 cent; vessels 500 tons or more, per ton, 1.2 cents. Passing vessels, per ton, 0.2 cent. Fishing boats, per voyage 6 cents. No charges for vessels which stop less than twenty-four hours.
*Bridge dues.*—For bridges outside the locks, vessels of 100 tons or more, 4 cents per vessel, both going and coming; larger ships pay 8 cents per vessel. Passing ships, which do not stop at Harlingen, pay 2 cents per vessel if they are under 100 tons and 8 cents when they are over 100 tons. For bridges inside the locks vessels under 50 tons pay 2 cents and above 100 tons pay 4 cents per vessel.
*Lock dues.*—Five-tenths cent per ton.
*Quay dues.*—Steamships, per ton, 0.2 cent; other vessels under 20 tons, per vessel, 6 cents. Vessels from 20 to 49 tons, per vessel, 10 cents; 50 to 249 tons, per vessel, 20 cents; 250 to 299 tons, per ton, 0.1 cent; 300 to 399 tons, per ton, 0.2 cent; 400 tons and more, 0.4 cent per ton.

*Den Helder.*

*Canal dues.*—For entering the canal a charge of 0.8 cent is made.

*'s Hertogenbosch.*

*Harbor dues.*—Six-tenths cent per ton, valid for fourteen days; in time of ice extended.

*Hoek of Holland.*

No charges.

*Leeuwarden.*

*Harbor dues.*—Six-tenths cent per ton and per voyage, valid for four weeks. Vessels under 26 tons, less tariff. Passing ships free if they do not stop longer than twenty-four hours, Sundays excluded.

*Leiden.*

*Harbor and bridge dues.*—Passing vessels are free of dues if they do not load or unload, and are allowed a three hours' stay to buy provisions for their own private use. For all other vessels, if not steamboats and under 10 tons, 4 cents per voyage; for boats and steamboats, 0.8 cent per ton and per voyage.

*Lemmer.*

*Harbor dues.*—Four-tenths cent per ton.

*Lock dues.*—Sea locks, 0.4 cent per ton; for inner locks, 0.2 cent per ton; double tariff by night.

*Maassluis.*

*Harbor dues.*—For vessels from 6 to 25 tons, 0.8 cent per ton; 26 to 50 tons, 1.2 cents; 51 to 75 tons, 1.6 cents; 76 to 100 tons, 2 cents; vessels above 100 tons, 2.4 cents. These dues are valid for vessels under 25 tons for fourteen days, for vessels from 26 to 50 tons for one month and for larger vessels for two months. For vessels which come only for repairing the dues are reduced.

*Middelburg.*

*Harbor dues.*—Four-tenths cent per ton.

*Middelharnis.*

*Harbor dues.*—Three cents per ton and per voyage.

*Nymegen.*

*Quay dues.*—Four-tenths cent per ton for every ten days. Vessels which do not stop longer than twenty-four hours and do not load or unload pay half tariff. Yearly tickets for passenger boats, 10 cents per ton; for steam cargo boats, same tariff, and for sail boats or tugs, 4 cents per ton. The same quay dues are paid for the harbors, but when the river is frozen 1.2 cents per ton is charged, valid for thirty days.

*Oranjekanaal.*

*Lock dues.*—At Locks 1, 2, or 3, from east to west, 0.4 cent per ton; in the opposite direction, 1.6 cents per ton. Empty vessels pay, for passing the locks in the first direction, nothing, and for passing in the other direction, half tariff. At the Oranjesluis 1.6 cents is paid, coming from both directions.

*Bridge dues.*—Only from vessels in the direction from west to east, 1 cent per ship and per bridge.

*Oudenbosch.*

*Harbor dues.*—Two cents per ton; vessels loaded with hay and leaving empty, 0.8 cent per ton. Vessels which enter empty to load clay, pulp, etc., 1.2 cents per ton. Vessels above 200 tons from September 1 to December 31, 4 cents per ton.

*Purmerend.*

*Harbor dues.*—For vessels up to 19 tons, 4 cents per vessel. For larger vessels for every 5 tons addition, 4 cents. Vessels not loading or unloading are twelve hours free. Afterwards the same tariff as before, valid for one week. Vessels which remain for longer than six days after having finished loading or unloading are bound to pay again the dues.

*Rotterdam.*

*Harbor dues.*—Vessels, other than steam or motor boats, under 10 tons pay 4 cents per voyage. All other vessels and boats pay 0.8 cent per ton per voyage, valid for seventeen days. Yearly tickets for sailing vessels 16 cents per ton, for steamboats 32 cents per ton.

*Bridge dues.*—Vessels above 250 tons, 24 cents; 250 to 201 tons, 20 cents; 200 to 150 tons, 16 cents; 150 to 101 tons, 12 cents; 100 to 76 tons, 8 cents; 75 to 51 tons, 6 cents; under 50 tons, 4 cents.

*Schiedam.*

*Harbor dues.*—For vessels coming from abroad 4 cents per ton, for other vessels 1.2 cents per ton, valid for twenty days. Vessels which have paid the dues, and remain over the winter empty from November to April, do not pay anything additional. This stipulation is not for sea and fishing boats, which pay 1.6 cents per ton for every twenty days, or 8 cents per year. Vessels which come only to take cargo from seagoing boats, and leave within twenty-four hours do not pay dues.

*Bridge dues.*—Vessels under 75 tons pay 2 cents; from 76 to 100 tons, 4 cents; from 105 to 150 tons, 6 cents; from 151 to 200 tons, 8 cents; from 201 to 250 tons, 10 cents; from 251 to 300 tons, 12 cents, more than 300 tons, 16 cents per vessel.

*Lock dues.*—Outside the lock for the first 30 tons, 20 cents per vessel; for every ton additional, 0.4 cents per ton. Inside lock. For vessels under 30 tons, 0.2 cents per ton, with a minimum of 4 cents. For vessels above 30 tons for the first 30 tons, 0.2 cents per ton, for the following 30 tons, 0.4 cent per ton.

*Sneek.*

*Harbor dues.*—Passing vessels which do not stop one night are free; vessels which do not load or unload 0.2 cent per ton; loading or unloading vessels 0.6 cent per ton.

*Spaarndam.*

*Lock dues.*—Vessels under 25 tons 18 cents; 25 to 50 tons, 24 cents; 51 to 75 tons, 30 cents; 76 to 100 tons, 30 cents; above 100 tons 49 cents.
*Bridge dues.*—Four cents per vessel.

*Stavoren.*

*Harbor dues.*—None.
*Lock dues.*—Four-tenths cent per ton.
*Canal dues.*—Four-tenths cent per ton; steam and motor boats 0.8 cent per ton.

*Utrecht.*

*Harbor dues.*—For vessels above 10 tons, 0.4 cent per ton; for vessels with hay, 2 cents per ton, valid for seventeen days.
*Lock dues.*—Vessels from 5 to 10 tons 6 cents per vessel; above 10 tons 0.6 cent per ton, for the tons above 300 tons half tariff. Passing vessels are free.

*Venlo.*

*Quay dues.*—Two and four-tenths cents per ton.

*Vlissingen.*

*Harbor dues.*—In the government harbor no dues are charged; in the local harbor 0.8 cent per ton is charged.

*Zaandam.*

*Harbor dues.*—For passenger boats which take passengers and cargo, 1.6 cents per ton; for ballast and fishing boats, 0.4 cent per ton. For passing boats, 0.6 cent per ton; for all other boats, 1 cent per ton. Yearly tickets for passenger boats, 40 cents per ton; for cargo and motor boats, 24 cents per ton; for ballast and fishing boats, 5 cents per ton; for all other boats, 16 cents per ton.
*Lock dues.*—According to the size of the vessel.
*Bridge dues.*—Ten cents per vessel.

*Zierikzee.*

*Harbor dues.*—For steamboats, 2.4 cents per ton. For sailing boats under 50 tons, 0.8 cents per ton; 51 to 100 tons, 1.2 cents per ton; 101 to 200 tons, 1.6 cents per ton; 201 to 400 tons, 2 cents per ton; 401 to 600 tons, 2.4 cents per ton; above 600 tons, 2.8 cents per ton.
*Bridge dues.*—Vessels under 40 tons, 4 cents per vessel; 40 to 60 tons, 6 cents; 60 to 80 tons, 8 cents; 80 to 150 tons, 10 cents; 150 to 200 tons, 12 cents; 200 to 300 tons, 16 cents; above 300 tons, 20 cents. During the night the tariff is doubled. Harbor dues are valid for thirty days, afterwards one-fourth of the tariff for every thirty days or part thereof.

*Zoutkamp.*

*Lock dues.*—Loaded vessels, 0.5 cent per ton; empty ones, 0.4 cent per ton.
*Quay dues.*—Six cents per day when loading, 12 cents per day when unloading.

*Zwartsluis.*

*Lock dues.*—For vessels wholly or partly loaded, 1 cent per ton. For empty vessels, 0.6 cent per ton.
*Harbor dues.*—According to size and kind of vessel, from 6 to 12 cents per vessel.

*Zwolle.*

*Harbor dues.*—Vessels from 10 to 20 tons, 3.6 cents per ton; for every ton additional, 2.4 cents per ton, valid for fourteen days.
*Bridge dues.*—For vessels under 10 tons, 2.8 cents; for larger vessels, 5 cents per vessel.

# CANALS AND WATERWAYS IN THE NETHERLANDS.

Report by S. Listoe.

*American Consul-General at Rotterdam.*

This report is in answer to the following list of questions prepared by the National Waterways Commission before its visit to Europe, and transmitted to divers consular officers through the Department of State.

1. How is the expense of improvement provided, both for original construction and for maintenance? Is it by the central government, by the constituent states or subdivisions, by localities immediately affected, or is it by a combination of the three? A statement of total expenditures for the respective improvements, including cost of annual maintenance, would be valuable.
2. Are there tolls or other charges for the use of waterways?
3. Is the amount of water-borne traffic increasing or diminishing?
4. What waterway improvements are under way or in contemplation, and what is the probable cost?
5. What commodities are most carried upon rivers or canals?
6. What are the rates on several specific commodities between localities to be specified, and how do these rates compare with the rates of carriage by rail?
7. What is the prevailing width and depth of waterways and canals?
8. What is the type, size, and draft of boats used? Is the tendency toward the substitution of the barge for the single boat, or the single boat for the barge?
9. What are the methods for the propulsion of boats?
10. What terminals are there for the loading or unloading of freight, and how are the terminals provided?
11. Is there any method for the transfer or interchange of freight between waterways and railways?
12. Is there any utilization of water power in connection with locks or other incidents of navigation?
13. What is the usual annual variation between high and low water, and at what seasons of the year is the water higher or lower?

## CANALS AND WATERWAYS IN THE NETHERLANDS.

The canals and waterways of the Netherlands may be said to consist of four groups: (1) Maritime or sea canals; (2) canals connecting with the Rhine; (3) lateral canals; and (4) inland canals.

### SEA CANALS.

In looking over the map of the Netherlands it will at once be observed that the coast is very extensive and in many places indented or cut into by arms of the sea, the Zuider Zee being the most conspicuous. The coast line of the North Sea from the "New Waterway" (Maas entrance to Rotterdam) to the extreme northern point "den Helder" is 75 miles long.

Judging from these facts it would appear that favorable conditions for foreign commerce and for the establishment of seaports present themselves; but this is not the case, as the depth of water along the coast is insufficient and the fine sand of which the coast line is formed descends into the sea with a gradual incline.

Navigation along the coast is thus not without danger, and vessels are obliged for their safety always to keep a considerable distance away from land, and besides it may be stated that the coast is greatly exposed to the severe actions of wind and weather.

For the above reasons it will be easily understood that the coast is only accessible to small fishing smacks of the class seen, for instance, at Scheveningen and Katwyk, where they land right on the beach, and even such fishing boats must be built especially for the purpose.

Seaports have been established in the earlier times along the Zuider Zee and on arms of the sea which run far into the interior. A large number of such ports might be mentioned, but at the present day it is only those of Amsterdam and Rotterdam which deserve our closer study and attention.

Beginning with Amsterdam, it is a well-known fact that since centuries its commerce has been of considerable importance. Favorably situated upon the sea arm the "Y," there was, hundreds of years ago, but one way of access and that was by the Zuider Zee; but the dimensions of vessels increased in course of time, and the Zuider Zee became more and more shallow, and in order to overcome these conditions it was decided to dig the first sea canal, the "North Holland Canal," the construction of which lasted from 1820 to 1852. It has a length of 50 miles and runs through the entire province of North Holland in a north and south direction.

The canal was only navigable for vessels drawing less than 17 feet of water, and it was admitted in the second half of the nineteenth century that this canal would soon prove insufficient for the requirements of the Amsterdam navigation.

In the years 1865–1876 the "North Sea Canal"—15 miles long—was constructed, giving Amsterdam a direct connection with the North Sea. It has since been greatly improved and enlarged, and the latest improvements having been finished it may be said that Amsterdam possesses a sea canal of the first rank and is accessible by vessels 720 feet long, 79 feet wide, and a draft of 30 feet.

Rotterdam, with its favorable location, its direct communication with the Rhine and the German hinterland on one side, and an open waterway in the opposite direction, now possesses all the requisites for an ever-increasing commercial navigation.

The conditions were not so favorable at the beginning of the past century; navigation on the Rhine was difficult, and at the mouth of the river in the North Sea there were found ever-moving sand banks, which presented threatening dangers to navigators bound to or coming from Rotterdam; vessels often had to discharge their cargoes partly into lighters before they could be brought up to Rotterdam, and in order to remove these obstacles and make it possible to compete with Antwerp the "Voornsche Canal" was projected and completed in 1831. In chronological order this was the second sea canal in the Netherlands.

This canal proved the wisdom of its creators for many years; but the conditions under which the mercantile navigation was carried on changed, the volume of business increased, and in 1863 it was decided to improve the river toward the east and to cut a new waterway to the sea.

This undertaking has been successfully brought to completion, and at the present day vessels drawing 32 feet can safely come up to Rotterdam. It is of interest to state here that the works for both the seaports Amsterdam and Rotterdam were commenced at the same time in 1866.

The only remaining canal of note used by seagoing vessels is from Ghent in Belgium, to Terneuzen in the Netherlands. Its construction was undertaken by the Belgian Government in order to bring Ghent into direct communication with the ocean via the river Schelde. This canal, which can accommodate vessels drawing 26 feet 6 inches with a length up to 465 feet and 56 feet beam, will doubtless prove an important factor in the commercial development of this Belgian city.

### CANALS CONNECTING WITH THE RHINE.

Rotterdam, situated on the Nieuwe Maas River, which is practically the outlet of the Rhine, is to a great extent indebted to the Rhine traffic for its prosperity, but the navigation on the canals connecting with the Rhine is of equal importance for the commercial growth of the city of Amsterdam. The latter city's connection with the Rhine was for many years through the small rivers Vecht and Krumme Rhine, passing Utrecht and Vreeswyck; but this route was difficult to navigate owing to its crookedness and insufficient depth, and so the Merwede Canal was planned and dug. It was finished in 1893 and has furnished a connection which answers all requirements of the Amsterdam trade. The old waterway, still in existence, is known as the "Keulsche Vaart," which is best translated as the "canal leading to Cologne."

The Rhine may be considered an international river. The navigation thereon thus far is free, no dues or taxation of any nature being exacted. It may be of interest to note that Antwerp has also profited by the existing conditions, and its trade with Germany by way of the Rhine is of the greatest importance. Lighters and barges were formerly navigated down the Schelde and soon reached Dutch territory, through which they proceeded along the navigable streams, and thus they reached Dordrecht, at which latter place they joined the rivers through which the Rotterdam lighters and barges are being moved.

When the Government of the Netherlands concluded, some fifty years ago, to construct a net of railroads through the entire country it was at the same time decided that the Province of Zeeland, which consists of a number of islands, should be connected with the mainland of Holland and thus be relieved from the seclusion in which it had heretofore been held.

In order to attain this result it was absolutely necessary to construct railroad dikes through the eastern Schelde and the Sloe, the two identical rivers which were essential to the navigation between Antwerp and the Rhine. It was hence arranged with Belgium to replace the above-named streams by two canals, one running through the island of South Beveland and the second through that of Walcheren, and in consequence the commerce and navigation of Antwerp did not suffer from any steps taken by the Dutch Government for the purpose of promoting better railroad connections in the Netherlands. The South Beveland Canal was completed in 1866 and that through Walcheren in 1873.

### LATERAL CANALS.

Throughout the Netherlands there are many rivers the navigation of which is of the greatest interest to the inhabitants of this country. Without citing the less important rivers there should be mentioned here (1) the Rhine coming from Germany, (2) the different branches of the Rhine, and (3) the Meuse coming from Belgium. The Schelde from Antwerp might also be named in connection with the above were it not that this waterway rather presents the character of an ocean inlet. It gives access to Antwerp, in Belgium, and on Dutch territory to Flushing Terneuzen.

The Netherlands Government has done much for the improvement of these rivers, and in connection herewith mention should be made of an extensive work undertaken in the last few years, viz, the construction of a new mouth for the Meuse and the entire separation of the two rivers Meuse and Waal. These works were begun in 1888 and have just been completed at a cost of over $10,000,000.

The Meuse is hardly navigable from Venlo up the river on account of its shallowness at certain times, and the rapid current is another inconvenience presenting many dangers to navigation. With a view of overcoming these obstacles the Zuid Willemsvaart Canal was dug by the Dutch Government in the years 1822–1826. Originally it started from Maasstricht and at Bois le Duc flows into the river Dieze, which has been canalized and empties into the Meuse a short distance from the last-named city.

In 1850 the Zuid Willemsvaart was prolonged to Liege, in Belgium, whence the Meuse is canalized and thus gives connection with the

Belgian and French canals. A branch of this canal leads to Antwerp and a second branch has been planned by the Netherlands government through North Brabant, where a well-developed industry is greatly in need of better communication by water.

A similar canal was inaugurated in 1829 from Apeldoorn to Hattem, on the Yssel, and forty years afterwards it was prolonged to Dieren, on the Yssel. Though this canal can at certain times replace to advantage the river Yssel, which, especially in former years, was not always navigable, it can not be said to be a pure type of lateral canal.

### INTERIOR CANALS.

Holland is for the greatest part a low and flat country and peculiarly adapted for the building of canals to the fullest extent, water being abundant. The country has been reclaimed from the sea and the waves by making dikes around the low land and pumping out the water; the Haarlem Lake, for instance, was reclaimed in the years between 1840 and 1852, and 45,000 acres of fertile land was in this manner added to the territory of Holland; the lake has disappeared, but a canal has remained suitable for inland navigation and entirely encircling the reclaimed "polder;" such canals are called "Ringvaart," which may be translated as "Belt canals."

There are in Holland many reclaimed lakes and all are surrounded by a belt canal. The provinces of North and South Holland, Utrecht, Groningen, and Friesland can boast of an extensive network of canals for inland navigation.

The history of all these canals can not be given in this report, as it would require a historical review of this country in its minutest details; reference should, however, be made to one special type of inland canal which has an exceptional status in not having been constructed for general interior navigation.

There are in this country vast tracts of land which are desolate, unfertile, and partly marshy; these lands are situated along the north eastern frontier of the Netherlands near Germany in the provinces of Groningen, Drenthe, and Overyssel, and in North Brabant.

The surface is covered to a smaller or larger depth with fen, which has been formed during centuries by the vegetation of different plants and trees, the decomposition of which and the action of standing water having caused this heath to become uniform and compact.

From this fen peat is made, which is valuable for heating purposes and for the peat moss manufacture; when the upper surface is removed good agricultural soil is reached.

In order to bring these peat fields into operation it has become necessary to dig canals for the transportation of the product.

The exploitation of the peat fields goes hand in hand with a complete transformation of the country; the soil is brought under cultivation, a population will settle down on the spot, and thriving villages, flourishing agriculture, yes, even an industry of great importance will replace the moors and marshy country of former years.

It is evident that the canals above mentioned play a very important part; originally dug for the transportation of peat they do not lose their value after the fen is exhausted, but become canals of the fourth group for inland navigation and are actively promoting the development of the part of the country through which they run.

ADMINISTRATION.

In conclusion I beg to add some information concerning the administration and financial side of the question under discussion.

In the Netherlands there are 265 different canals aggregating a total length of 2,100 miles; of these there are 20, with a total length of 326 miles, built and maintained at the expense of the Government, viz, those of the first, second, and third group, and a few of the inland canals which are of the greatest interest to inland navigation.

The other canals belong to and are maintained by the provinces, communities, "polders," and various societies and individuals.

For full details regarding them, reference is made to the publications of the Department of Waterstaat entitled "Review of the navigable canals in the Netherlands."

As to the financial side it may be truthfully stated that as a rule the canals do not pay as an investment: this is quite natural as far as the Government canals are concerned, as they are entirely free, all dues having been abolished in 1900. The expenses of the maintenance of the Government canals during 1908 amounted to $700,000. (See Exhibit No. 1 at the end of this report.)

The provinicial and a large number of the canals of Group IV are also navigated free of charge. The general idea is that expenditures upon the construction and maintenance of canals are fully repaid by the direct results derived therefrom, viz, the advancement and development of agriculture and industry. It is also worth considering that a large number of these canals in this low country are indispensable for the purpose of carrying off the superfluous water.

DUES AND TOLLS.

This question is of a more complicated nature in the Netherlands than in any other country, which fact is attributable to various causes.

Whereas in other countries canals are exclusively constructed for the purpose of navigation, those of Holland are in many cases to a considerable extent also used for drainage purposes. They were as a rule not constructed in accordance with a properly organized plan, but were dug independently, as the necessity for their creation made itself felt.

The mouths of the canals were closed by sluices or gates whenever they joined other waterways with a view to protecting surrounding land against flooding, and they served navigation only in a secondary manner.

To the above may be added that the political situation in centuries past was such that each town was a small republic in itself, having its own particular form of government, with rights and privileges which were jealously guarded.

Instead of giving consideration to the general welfare of the whole country these towns only looked to their own interests and not an inch beyond that.

For these reasons a large number of navigable canals are, even at the present day, administered by "waterschappen," being local societies for the protection of land against flooding and for the drainage of ditches and inland waters; whenever navigation is tolerated it is only with an object of earning an extra revenue.

During the past thirty years numerous canals have been constructed through the peat fields in certain parts of the Netherlands, and the collection of tolls has been the only way of meeting expenses for their maintenance, for paying of interest, and for liquidation of the original construction capital.

It is only since the constitution of the present Kingdom was adopted that the Government has taken up the question of providing navigable canals and waterways, and during the last fifty years, the provinces have done much in the construction of canals and especially for their improvement, and thus the defective system of the olden times has been to some extent remedied.

As a general rule it can be stated that tolls are collected on all canals in the Netherlands with the exception of those under the administration of the Government.

Several of the tariffs of canal tolls are based upon privileges granted and contracts made in past times, some even going back, as far as the time of Charles V, and there are many in force of which the origin can not even be traced.

The ordinary manner of collection of tolls is when vessels pass through the sluices; the rates are generally not high, varying from one-fifth to two American cents per cubic meter (37 cubic feet) for each sluice; when such sluices are far apart, as in the Provinces of Groningen and Friesland, it is customary to collect such tolls also at bridges.

The average rate per ton-kilometer is calculated at about $0.0012.

In many instances the cost of maintenance exceeds the amount collected for tolls, and in such cases there can be no question of a return on the investment or liquidation of the cost of construction.

The praiseworthy example which the Government set in 1900 by abolishing all tolls and dues on roads and navigable waterways in the Netherlands is not likely to be soon followed by Provinces, communities, "waterschappen," and individuals owning and maintaining canals. Such measures would seriously upset the financial conditions of the interested communities and parties, and unless all canals are bought up by the Government this end will probably not be reached in any near future.

As has already been stated above, the inland navigation is not too heavily burdened by canal dues in this country. It is only in exceptional cases that the income from dues and tolls is sufficient to pay for maintenance as well as the establishment of a sinking fund for the original cost of construction.

This might be reached by levying higher rates on vessels making use of the canals, but it is feared that navigation under such circumstances would not be able to compete with other modes of transportation.

It must further be taken into consideration that a large number of the canals in the Netherlands are essential for the drainage of the country, and it would thus be unjust to charge navigation with all the expenses.

The expenditures for the maintenance of the Government canals for 1908 have amounted to about $700,000; pertinent information in connection with this item is given in the statement hereto attached.

WATER-BORNE TRAFFIC.

Whether the water-borne traffic is increasing and to what extent is shown in the following table, giving the number of vessels and tonnage engaged in the inland and the Rhine navigation of Rotterdam for the past six years:

| Year. | Number of vessels. | Metric tons. |
|---|---|---|
| 1908 | 121,374 | 23,541,045 |
| 1907 | 123,507 | 24,573,332 |
| 1906 | 120,059 | 22,445,574 |
| 1905 | 114,222 | 20,731,957 |
| 1904 | 108,988 | 19,024,044 |
| 1903 | 106,144 | 17,785,342 |

The Rhine trade movement between the ports of Amsterdam and Rotterdam and Germany is shown by the statement of Consul Morgan on page 40.

The only canal which is in the course of construction is that branching off the Zuid Willemsvaart through the Province of North Brabant.

The canal from Ghent to Terneuzen has been completed, and a periodical entitled "Ingenieur," for July, 1909, contains a full description thereof, with drawings and details which may be of interest.

The commodities which are carried on the rivers and canals cover everything in the character of the mercantile line. The principal articles which are shipped up and down the Rhine are coal, ore, cereals, iron, and timber.

*Comparison of rail and water rates.*

The freight rates for merchandise carried on canals, in comparison with those charged by railroads, vary from 100 to 1,000 per cent; whereas the railroad rates are stationary, the freight rates on canals and waterways fluctuate considerably, according to different conditions affecting navigation.

The following examples of the prevailing rates at the present time will fully corroborate the above statement.

The rates between Rotterdam and Ruhrort (Germany) are:

| | |
|---|---|
| For coal, ore, iron, etc., per ton: | |
| By water | $0.11–$0.12 |
| By rail | 1.30 |
| For cereals and timber, per ton: | |
| By water | .20 |
| By rail | 2.00 |
| For general merchandise, per ton: | |
| By water | .36– .72 |
| By rail | 3.34 |
| 5-ton carload lots, by rail | 2.50 |
| 10-ton carload lots, by rail | 2.30 |

Rates between Rotterdam and Frankfort on the Main are:

| | |
|---|---|
| For ores, per ton: | |
| By water | $1.00–$1.60 |
| By rail | 2.70 |
| For cereals, per ton: | |
| By water | 1.00– 1.60 |
| By rail | 4.58 |

For general merchandise, per ton:

| | |
|---|---|
| By water | 1.20– 1.80 |
| By rail | 8.56 |
| 5-ton carload lots, by rail | 6.24 |
| 10-ton carload lots, by rail | 5.64 |

The width and depth of the canals in the Netherlands are given in the Review of Navigable Canals hereto referred to.

### TYPE OF BOATS.

In the inland navigation of the Netherlands the single boat is used, but the Rhine transportation is carried on by lighters, which are towed in fleets of six along the rivers toward their respective destinations.

The methods of propulsion of boats are by steam, gasoline, wind, and towing. Special attention should be called to the fact that the gasoline motors are making rapid strides. "They are put into anything that will float" was the expression of an official of high standing connected with navigation. The market boats which keep up the weekly intercourse between market towns and inland villages were, up to a few years ago, brought to their destination by winds only, but they are now being moved along at a considerable speed by the gasoline or petroleum motor.

### TERMINALS.

The terminals for the loading and unloading of freight are the public quays along the water edges, and those owned by private individuals. The railroad tracks have been built all over the quays of this city and thus afford ample means for the interchanging of freight with ocean navigation.

With the exception of a few bridges in the city, which are opened by hydraulic pressure, water power is not utilized in connection with locks and other incidents of navigation. As far as I have been able to ascertain, there are only two sluices or locks which are opened by electricity, viz, those at Ymuiden on the North Sea Canal to Amsterdam and at Terneuzen on the canal to Ghent, which has recently been completed.

The usual variation between high and low water at Rotterdam is 5 feet and is, to some extent, influenced by the wind. There is a smaller depth of water in the rivers of Holland when the wind is blowing from the east than when coming from the west, as the latter prevents the water from flowing out to sea at ebb tide.

In conclusion, I beg to state that the greatest part of the information contained in this report has been most courteously contributed by Mr. R. O. van Manen, late inspector-general of Waterstaat at The Hague, and Mr. M. Deking Dura, the late chief engineer of the provincial Waterstaat of Oberyssel.

S. Listoe,
*Consul-General.*

Rotterdam, The Netherlands,
*September 14, 1909.*

## Exhibit No. 1.

*Statistics of government canals in Holland.*

| | Expenses of maintenance 1908. | Length of the canal.[a] | Dimensions of vessels. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Length. | Beam. | Draft. | Length. | Beam. | | Draft. | |
| Canal from Amsterdam to the Merwede (Rhine Canal) | *Florins.* 211,000 | *Kilometers.* 70.9 | *Meters.* 100.00 | *Meters.* 10.5 | *Meters.* 2.20–2.60 | *Ft.* 328 | *Ft.* 34 | *in.* 5 | *Ft.* 7<br>8 | *in.* 2<br>6 |
| Zuid - Willemsvaart (in Holland) | 155,000 | 78.0 | 50.00 | 5.00 | 1.90 | 164 | 16 | 5 | 6 | 3 |
| Canalized Dieze | 11,000 | 5.8 | 90.00 | 12.30 | 2.10 | 294 | 40 | 5 | 6 | 11 |
| Canal Dieren-Hattem | 21,500 | 54.6 | 30.00 | 5.90 | 1.56 | 98 | 19 | 4 | 5 | 1½ |
| Canal of Voorne | 26,500 | 10.5 | 110.00 | 13.70 | 5.00 | 361 | 45 | 0 | 16 | 5 |
| North Holland Canal | 116,000 | 80.4 | 64.00 | 15.00 | 5.00 | 210 | 49 | 3 | 16 | 5 |
| Amsterdam Ship Canal (North Sea Canal) | 633,000 | 27.0 | 220.00 | 24.00 | 9.20 | 720 | 78 | 9 | 30 | 3 |
| Canal from Amsterdam to Vreeswyk (almost abandoned) | 8,000 | 61.3 | 52.00 | 7.50 | 2.10 | 170 | 24 | 7 | 6 | 11 |
| Ghent - Terneuzen Canal (in Holland) | 59,500 | 14.3 | 140.00 | 17.50 | 8.10 | 465 | 57 | 5 | 26½ | 0 |
| Canal of Zuid-Beveland | 240,000 | 7.8 | 100.00 | 15.75 | 6.20 | 328 | 51 | 8 | 20 | 4 |
| Canal of Walcheren | 143,000 | 13.3 | 130.00 | 19.75 | 7.10 | 427 | 64 | 9 | 23 | 3 |
| Canal of Dokkum to Gerben-Allesverlaat | 24,000 | 17.0 | ..... | 5.00 | 1.40 | ..... | 16 | 5 | 4 | 7 |
| Meppelerdiep | 28,000 | 11.3 | 60.00 | 7.80 | 1.80 | ..... | 25 | 7 | 5 | 10 |
| Willemsvaart | 17,500 | 2.2 | 94.75 | 11.80 | 3.00 | 308 | 38 | 8 | 9 | 10 |
| Main canal of Drenthe and canal of Beilen | 37,000 | 53.8 | ..... | 4.85 | 1.41 | ..... | 15 | 11 | 4 | 7½ |
| Veenhuizer Canal | 4,500 | 12.6 | ..... | 4.85 | 1.41 | ..... | 15 | 11 | 4 | 7½ |
| Total | 1,735,500 | 520.8 | ..... | ..... | ..... | ..... | ..... | | ..... | |

[a] 1 mile = 1.609 kilometers; 520.8 kilometers = 326 miles; 1,735,500 francs = $700,000.

# APPENDIX.

*Classification of freight on railways of Holland.*

| Article. | Class. | Remarks. |
|---|---|---|
| Anvils | B | |
| Alkali | C | |
| Alpine grass | (1) | |
| Alum | B | |
| Aluminous earth | B | |
| Alum stone | B | |
| Aluminum | B | |
| Ammoniac water (no gas water) | B | |
| Anchors (ships') | B | |
| Anise seed | (2) | Transported in closed or covered cars. |
| Apples, fresh | (2) | |
| Ashes, not specially mentioned | B | |
| Ash, pearl, must be covered by shippers | B | |
| Ash, pot, must be covered by shippers | B | |
| Asphalt, or asphaltos, liquid | B | |
| Asphalt earth | C | |
| Asphalt, pipes of | B | |
| Asphalt cement, in blocks | C | |
| Asphalt paste | C | |
| Asphalt, artificially made | C | |
| Asphalt | C | |
| Asphalt, in plates | C | |
| Asphalt sand | C | |
| Axles, with or without wheels | B | |
| Acorus | B | |
| Agricultural implements, common, as rakes, spades, and the like. | B | |
| Agricultural implements, not undone, as thrashing machines, extirpators, hayrakes, mowing machines, steam plows, straw cutters, sewing machines of such measure that four or more may be put in one car. | B | For agricultural implements of such measure that only two can be put on one car the freight will be calculated at four times the real weight. If a charge according to the tariff on vehicles is more in favor of the shippers, the freight will be calculated according to this tariff. Agricultural implements of such measure that only one can be put on a car are charged for according to the tariff on vehicles on two wheels. If these implements are wholly or in part constructed of iron they will be charged for according to the exceptional bulky goods class, respectively, class B. |
| Aerated waters, in jugs | B | |
| Acids, mineral | B | |
| Acid, oleine | B | |
| Acid of saltpeter | B | |
| Acid, salto | B | |
| Acid, sulphuric | B | |
| Bathing carriages | B | |
| Basins, iron | B | |
| Beams, iron | B | |
| Band iron | B | |
| Bank screws | B | |
| Basalt stone | C | |
| Bedding of down, capoc, or feathers | (1) | |
| Bones | C | |
| Bone flour, as fertilizer | C | On the dispatch note accompanying the goods must be clearly stated "For fertilizing purposes." |
| Boneblack, mixed with earth, as fertilizer | C | |
| Beet-root sirup, not refined (molasses) | B | |
| Beet-root fibers | C | |
| Berries, of all kinds, fresh | (2) | Transported in closed or covered cars. |
| Beechnuts | (2) | |
| Brooms, of heather | B | |
| Brooms, of reeds | B | |

[1] Exceptional tariff 1.

[2] Exceptional tariff 2.

*Classification of freight*—Continued.

| Article. | Class. | Remarks. |
|---|---|---|
| Beer, in casks | B | Always transported in closed cars. |
| Bisulphate | B | |
| Bitumen | C | |
| Bleaching earth | B | |
| Bleaching chalk | B | |
| Bleaching powder | B | |
| Blood, in closed barrels | C | |
| Buckwheat | (1) | Transported in closed or covered cars. |
| Buckwheat groats | (1) | Do. |
| Bark, of trees, ground or crude | B | |
| Beans, not specially mentioned | (1) | Do. |
| Beansticks | C | |
| Boats, rowing and other | B | |
| Butter, both artificial and natural, in boxes, tins, cases, baskets, pots, or casks. | B | |
| Butter churns | (2) | |
| Butter oil | B | |
| Bolts, iron | B | |
| Butter tubs | (2) | |
| Brown-coal briquettes | C | |
| Charcoal briquettes (must be covered by shippers). | C | |
| Briquettes, coal | C | |
| Briquettes, peat | C | |
| Bridges, parts of, constructed of iron and steel | B | |
| Brown coals | C | |
| Brownstone | C | |
| Butterine | B | |
| Beehives, empty | (1) | |
| Boxes, of wood | B | |
| Buckets, wooden | B | |
| Bottles, common (empty) | B | |
| Bottles, chemist's (empty) | (2) | |
| Bottles, medicine (empty) | (2) | |
| Barley, including pearl barley | (1) | Do. |
| Blackbirds, steel | C | |
| Blackbirds, iron | C | |
| Booths, undone | B | |
| Baby carriages | (2) | |
| Boxes, empty cigar | (2) | |
| Bullets, iron | B | |
| Baskets | (2) | |
| Black lead | B | |
| Bicycles | (2) | As undone are regarded only bicycles of which the handle bar, the pedals, and the saddle can be taken off at the same time, and tricycles of which the front or back wheels can be taken off the axle and tied up to the third wheel. |
| Bark (no cork bark), ground or crude, must be covered by shippers. | B | |
| Bricks | C | |
| Brick, kiln | C | |
| Barrels, wooden (empty) | (2) | |
| Barrels, iron (empty) | B | |
| Bird cages | (2) | |
| Bird's seed | (1) | |
| Bran | (1) | Transported in closed or covered cars. |
| Barrels, bottoms of wooden | B | |
| Beans, preserved in casks | B | |
| Beet root, red, eatable | (1) | |
| Chemists' bottles | (2) | |
| Coco shells | (1) | Do. |
| Carbolineum | B | |
| Cardboard, manufactures of, weighing less than 200 kilograms (440 pounds) per cubic meter (3 cubic feet). | (2) | |
| Cellulose, dry, must be covered by shippers | B | |
| Cellulose, moist | B | |
| Cement, including the following manufactures of cement: Pipes, plates, draining pipes, stones, tiles, etc. | C | |
| Cement, manufactures of, not specially mentioned. | B | |
| Cement steel | B | |
| Cement iron | C | |
| Chile saltpeter (as fertilizer) | C | |
| China clay | C | |
| Chlorine kali | B | |
| Chloride of lime | B | |
| Chloride acid | B | |
| Chlorine zinc | B | |

[1] Exceptional tariff 2.

[2] Exceptional tariff 1.

*Classification of freight*—Continued.

| Article. | Class. | Remarks. |
|---|---|---|
| Chicory roots, dried | (1) | Transported in closed or covered cars. |
| Chicory roots, fresh | C | |
| Cocoanut oil | B | |
| Coke | C | |
| Creosote | B | |
| Creosote oil | B | |
| Crossings | B | |
| Carding thistles | (2) | |
| Crossbars, wooden | C | |
| Charcoal, must be covered by shippers | C | |
| Cables, iron | B | |
| Chaff | (1) | Do. |
| Calamine | C | |
| Canary seed | (1) | |
| Capoc, pure, in unpressed bales | (2) | The bales will be considered as unpressed when they weigh less than 100 kilograms (220 pounds) per cubic meter (3 cubic feet). |
| Churns, empty | (2) | |
| Clay | C | |
| Cakes, linseed, rape-seed, and other cakes, used for fodder. | (1) | Transported in closed or covered cars. |
| Cakes, tan, covered by shippers | C | |
| Caraway seed | (1) | |
| Cotton meal | (1) | |
| Cotton seed | (1) | |
| Cotton-seed meal | (1) | |
| Cotton-seed oil | B | |
| Cobbles | C | |
| Chains, iron | B | |
| Cases, of tin plate | (2) | |
| Cases, of wood, empty | (2) | Not including so-called nest cases, i. e., empty cases put into each other. |
| Cases, nest | B | |
| Claws of animals | B | |
| Clover seed | (1) | Transported in closed or covered cars. |
| Crossbars, wood | B | |
| Cast iron | C | |
| Coal dust | C | |
| Columns, iron | C | |
| Cumin | (1) | Transported in closed or covered vans. |
| Cabbage, fresh | (1) | Do. |
| Coal powder | B | |
| Coal tar, in barrels | C | |
| Coal-tar pitch | C | |
| Copperas (iron vitriol) | C | |
| Copper stone | C | |
| Coriander seed | (1) | Do. |
| Cramps, iron | B | |
| Crystal soda | C | Do. |
| Crucibles, stone | B | |
| Crucibles, iron | B | |
| Chalk, crude, in pieces | B | |
| Coopers' articles not specially mentioned | (1) | Butter tubs put into each other are charged for according to the real weight. |
| Cork | (1) | |
| Cork bark, ground or crude, must be covered by shippers. | (1) | |
| Cod-liver oil, in casks | B | |
| Cars for transportation of the oil, undone | (2) | When the cars are not undone they will be charged for as "Vehicles on 2 wheels." |
| Cigar boxes, empty | (2) | |
| Cinders | C | |
| Chips of wood, must be covered by shippers | B | |
| Coal briquets | C | |
| Coal | C | |
| Chairs | (2) | |
| Chairs, skeletons of | (2) | |
| Cordage | B | |
| Carrots | (1) | |
| Churning machines | (2) | |
| Chestnuts | (1) | |
| Cabbage, preserved in casks | B | |
| Copra | (1) | Transported in closed or covered cars. |
| Demijohns | (2) | |
| Doors and door frames, not painted or varnished | B | May be painted with minium. |
| Down | (2) | |
| Draining tubes | B | |
| Dyewood, in blocks or pieces | B | |
| Dust, from mills | (1) | Transported in closed or covered cars. |
| Disks | B | |

[1] Exceptional tariff 2.

[2] Exceptional tariff 1.

*Classification of freight*—Continued.

| Article. | Class. | Remarks. |
|---|---|---|
| Drums, of plate iron | (1) | |
| Earth, not specially mentioned | C | |
| Earthenware | B | |
| Earthnut oil | B | |
| Earthnuts | (2) | Transported in closed or covered cars. |
| Earthnut cakes | (2) | Do. |
| Earthnut meal | (2) | Do. |
| Emeril | B | |
| Epsom salts | B | |
| Eggs | B | Always transported in closed cars. |
| Edges, of wood, for lids, sifts, etc | (1) | |
| Flour [2] | (2) | Transported in closed or covered cars. |
| Flowers, wrapped up in a manner so that other articles may be loaded in the same car. | B | When a shipment does not cover more than half the surface of the bottom of the car, and a charge for 2,500 kilograms (5,500 pounds) according to class A is more in favor of the shippers, this charge will be made instead of the charge according to class B. |
| Flower pots, of common red earthenware | B | |
| Fire engines, running on two wheels, of such a size that they can pass through the doors of a common 10-ton goods van, and are mentioned as bulky goods; otherwise they will be charged for according to the tariff for vehicles. | (1) | |
| Fur nuts | C | |
| Frames for slates | B | |
| Furniture, of wood, not wholly undone | (1) | The calculation of the freight is not changed if the furniture is wholly or partly filled with clothes or other articles. |
| Furniture, of wickerwork | (1) | |
| Fruit, fresh | (2) | Transported in closed or covered cars. |
| Foot stoves, white wood | B | |
| Fagots | C | |
| Feathers | (1) | Feathers, pressed in bales, weighing 100 kilograms (220 pounds) per half cubic meter (11 feet) are not classed under exceptional tariff 1. |
| Fruits, of the earth, fresh, not specially mentioned | (2) | Transported in closed or covered cars. |
| Fat | B | |
| Fodder cakes, not specially mentioned | (2) | Do. |
| Fodder meal | (2) | Do. |
| Fuller's earth | C | |
| Fruits, from trees, field, garden, etc., not specially mentioned (except grapes, oranges, citrons, and in general all kinds of green fruits and drugs). | (1) | Do. |
| Fire kindlers, consisting principally of cork | (1) | |
| Ferruginous vitriol | C | |
| Filings of iron | C | |
| Gas lime, as fertilizer | C | |
| Gas water, as fertilizer | C | |
| Guns, wood for | B | |
| Gigs and the like | B | |
| Gypsum, must be covered by shippers | C | |
| Globes, glass (empty) | C | |
| Glass, shivers of | C | |
| Glazing ore | C | |
| Grains, not specially mentioned | (2) | Do. |
| Granite, polished | B | |
| Granite, unpolished | C | |
| Graphite | B | |
| Grass seeds | (2) | Do. |
| Gravel | C | |
| Ground nut oil | B | |
| Ground nuts | (2) | Do. |
| Groundnut cakes | (2) | Do. |
| Groundnut cake flour | (2) | Do. |
| Groundnut flour | (2) | Do. |
| Groats | (2) | Do. |
| Guano | C | |
| Gutta-percha wares | (1) | |
| Goods in connection with shows or fairs, as decorative articles, costumes, waxen images, museums, merry-go-rounds, dogs, monkeys, etc. (not including horses, camels, elephants, giraffes, and wild animals). | ..... | By payment of freight for at least 5,000 kilograms (11,000 pounds), to be charged for according to class B. |
| Grease, also cart grease | B | |
| Green, of pine trees | C | |
| Garden fruits, fresh, not specially mentioned | (2) | |
| Grease pots, for wheels | B | |
| Gypsum plates | C | |
| Grass sods | B | |
| Hogsdraff | (2) | Transported in closed or covered cars. |

[1] Exceptional tariff 1.

[2] Exceptional tariff 2.

*Classification of freight*—Continued.

| Article. | Class. | Remarks. |
|---|---|---|
| Harrows | B | |
| Hook bolts | B | |
| Hair, as fertilizer (i. e., hair of animals, unwashed and uncleaned, mixed with other refuse of hides). | C | |
| Hearth ashes | C | |
| Heather | B | |
| Hemp, in unpressed bales | (1) | |
| Hempseed | (2) | Transported in closed or covered cars. |
| Hook iron | B | |
| Hoops, wooden | (1) | |
| Hoops, iron | B | |
| Hay, in pressed bales, must be covered by shippers. | B | |
| Hay, in unpressed bales, must be covered by shippers. | (1) | |
| Hop, in unpressed bales | (1) | The bales will be considered as unpressed when they weigh less than 187 pounds per cubic meter (3 cubic feet). |
| Hop poles | C | |
| Hides, green, dried, or salted | B | |
| Horse-radish | (2) | Transported in closed or covered cars. |
| Horse beans | (2) | Do. |
| Hogwash, dry or wet | C | |
| Hardware, consisting wholly or in part of iron, iron, unpolished, and not specially mentioned. | B | |
| Hats | (1) | |
| Hoofs of animals | B | |
| Ice sleighs, of a measure that they can pass through the doors of common baggage or closed goods vans. | (1) | Has to be paid for as express goods only when transportation by specially designated train is desired. |
| Iron, white | B | |
| India rubber | C | |
| Iron wire | B | |
| Incandescent lamps, unmounted | (1) | |
| Ice | (1) | Transported in closed or covered cars. |
| Iron, old | C | |
| Iron, bar | B | |
| Iron, in blocks, rough | C | |
| Iron ore | C | |
| Iron stone | C | |
| Iron wares, cast | B | |
| Jack screws | B | |
| Jugs (covered with wicker work) | (1) | |
| Jugs, stone | B | |
| Kindling wood | C | |
| Kali | C | |
| Kaolin | C | |
| Kettles, iron | B | |
| Kitchen utensils, iron | B | |
| Kitchen salt | (2) | |
| Kiln brick | C | |
| Lime, must be covered by shippers | C | |
| Lime ash | C | |
| Limestone | C | |
| Lamp glasses | (1) | |
| Loam | C | |
| Locomotives, not running on their own wheels | B | |
| Lead earth | C | |
| Lead ash | B | |
| Lucerne seed | (2) | |
| Lupines | (2) | Do. |
| Lupine seed | (2) | Do. |
| Linseed | (2) | Do. |
| Linseed cake | (2) | Do. |
| Linseed meal | (2) | Do. |
| Linseed oil | B | |
| Leguminous plants, peeled and unpeeled | (2) | Do. |
| Middlings | (2) | Do. |
| Meal | (2) | Do. |
| Match boxes, empty | (1) | |
| Mucilage, including bone glue | B | |
| Machines (no sewing), undone | B | Not including machines of which only some parts have been taken off. |
| Magnesite, crude | C | |
| Magnesite, powdered or ground | C | |
| Maize | (2) | Transported in closed or covered vans. |
| Margarine | B | |
| Marble, polished | B | |
| Marble, in blocks | C | |
| Marble, pillars | C | |
| Medicine bottles, empty | (1) | |
| Madder roots | B | Do. |

[1] Exceptional tariff 1.

[2] Exceptional tariff 2.

*Classification of freight*—Continued.

| Article. | Class. | Remarks. |
|---|---|---|
| Meal of earthnuts | (1) | Transported in closed or covered vans. |
| Meal of earthnut cake | (1) | Do. |
| Meal of grains, not specially mentioned | (1) | Do. |
| Meal of groundnuts | (1) | Do. |
| Meal of groundnut cakes | (1) | Do. |
| Meal of meal of linseed cake | (1) | Do. |
| Meal of linseed | (1) | Do. |
| Meal of rape-seed cakes | (1) | Do. |
| Meal of sesame cakes | (1) | Do. |
| Meal of sesame seed | (1) | Do. |
| Meal of fodder cakes, not specially mentioned | (1) | Do. |
| Molasses | B | |
| Marl | C | |
| Marlstone | C | |
| Manure, not specially mentioned | C | |
| Mineral smear oil | B | |
| Millstones | C | |
| Mussels | B | |
| Mussel seed | (1) | Transported in closed or covered cars. |
| Malt (not roasted) | (1) | Do. |
| Motor cycles with two wheels | (2) | Motor cycles with three wheels are to be charged for according to the tariff on vehicles, as vehicles on two wheels. |
| Mooring posts | C | |
| Marble, in plates | B | |
| Nails, steel | B | |
| Nails, iron | B | |
| Nuts and bolts | B | |
| Naphtylamine | B | |
| Nitric acid | B | |
| Osteocolla | B | |
| Ores, of all kinds, except gold and silver ores | C | |
| Oatmeal | (1) | Transported in closed or covered cars. |
| Oats | (1) | Do. |
| Ocher | C | |
| Oleine | B | |
| Oleomargarine | B | |
| Oil, earthnut | B | |
| Oil, butter | B | |
| Oil, coconut | B | |
| Oil, creosote | B | |
| Oil, groundnut | B | |
| Oil, cottonseed | B | |
| Oil, linseed | B | |
| Oil, palm | B | |
| Oil, paraffin | B | |
| Oil, rapeseed, refined | B | |
| Oil, rapeseed, crude | B | |
| Oil, sesame | B | |
| Oil, smear, mineral | B | |
| Oil, solar | B | |
| Oil of talc | B | |
| Oil, tar | B | |
| Oil, turpentine | B | |
| Oil holders, of glass | (2) | |
| Oil pots, for wheels | B | |
| Oil, not specially mentioned | (1) | |
| Osier twigs | C | |
| Onions | (1) | Do. |
| Potatoes, fresh, dried, or sliced | (1) | Do. |
| Potato flour | (1) | Do. |
| Planks, small and large | B | |
| Peas | (1) | Do. |
| Plants and shrubs, when they are not wrapped up in a manner that other articles may be loaded in the same car. | (2) | When a shipment does not cover more than half the surface of the bottom of a car, and a charge for 2,500 kilograms (5,500 pounds) according to class A is more in favor of the shippers, the charge will be consequently made, instead of exceptional tariff 1. Plants and shrubs, alive, only includes such plants which are still provided with roots. Live branches of trees, etc., will not be regarded as such, even though they may be intended for grafting. |
| Plaster stone | C | |
| Pushing carts, small, both loaded and empty | (2) | This includes pushing carts of such measure that they can pass through the doors of a common goods van. Larger carts are to be classified under the tariff for vehicles. |
| Pitch | B | |
| Pebble stones, artificial | C | |

[1] Exceptional tariff 2.

[2] Exceptional tariff 1.

*Classification of freight*—Continued.

| Article. | Class. | Remarks. |
|---|---|---|
| Poppy seed | (1) | Transported in closed or covered cars. |
| Parts of machines, steel, including those of which the chief elements consist of steel. | B | |
| Parts of machines, iron, including those of which the chief elements consist of iron. | B | |
| Pearl ash, must be covered by shippers | B | |
| Pearl barley | (1) | Do. |
| Palm oil | B | |
| Paper, old, in pressed bales, must be covered by shippers. | B | |
| Paper scraps, in unpressed bales | (2) | |
| Paraffin oil | B | |
| Paraffin | B | |
| Patent oil | B | |
| Pitch, coal tar | C | |
| Pitch, not specially mentioned | B | |
| Pegs, wooden | B | |
| Pears, fresh | (1) | Do. |
| Petroleum, refined | B | |
| Petroleum (gas) tar | C | |
| Phosphates, as fertilizer | C | |
| Phosphorite, as fertilizer | C | |
| Plates, marble | B | |
| Plows, common | B | |
| Plow irons | B | |
| Porcelain shivers | C | |
| Potash, must be covered by shippers | B | |
| Potter's wares | B | |
| Pots, oil and grease, for wheels | B | |
| Projectiles, iron | B | |
| Pumice stone | C | |
| Pine resin | B | |
| Pipe clay | C | |
| Pipes, iron | B | |
| Pipes of metal (except lead) | B | |
| Pineapples | C | |
| Pine trees, green of | C | |
| Posts for coal mines | C | |
| Peat dust, must be covered by shippers | C | |
| Paving stones, polished or painted | B | |
| Paving stones, unpolished or unpainted | C | |
| Paving stones, marble | B | |
| Periwinkles | B | |
| Petroleum, unrefined | B | |
| Plates of lime, mixed with sand | C | |
| Planks for cigar boxes | B | |
| Pipes, iron condensation | B | |
| Pipes, drainage | B | |
| Pipes, of asphalt | B | |
| Pipes, of wood | B | |
| Pipes, of stone | B | |
| Pipes, of iron | B | |
| Quartz | C | |
| Refuse of beet roots | C | |
| Refuse of tin plate | C | |
| Refuse of yarns | B | |
| Refuse of grains | (1) | Transported in closed or covered cars. |
| Refuse of horns | B | |
| Refuse of hides | B | |
| Refuse of cotton, pressed in bales | B | |
| Refuse of cotton, in unpressed bales | (2) | |
| Refuse of leather | B | |
| Refuse of flour | (1) | Do. |
| Refuse of metals, except lead and copper | C | |
| Refuse of paper, in pressed bales, must be covered by shippers. | B | |
| Refuse of paper, in unpressed bales | (2) | |
| Refuse of reeds | B | |
| Refuse of rice | (1) | Do. |
| Refuse of steel | C | |
| Refuse of flax, in pressed bales | B | |
| Refuse of flax, in unpressed bales | (2) | |
| Refuse of fruits | (1) | Do. |
| Refuse of wool, in pressed bales | B | |
| Refuse of wool, in unpressed bales | (2) | |
| Refuse of iron | C | |
| Refuse of salt | C | |
| Refuse of soap | C | |
| Refuse of tapestry | B | |
| Refuse of tapestry in unpressed bales | (2) | |
| Refuse, not specially mentioned | (3) | |

[1] Exceptional tariff 2. [2] Exceptional tariff 1. [3] Same class as the article from which the refuse comes.

*Classification of freight*—Continued.

| Article. | Class. | Remarks. |
|---|---|---|
| Roofing slates | C | Transported in closed or covered cars. |
| Roofing tiles (stone) | C | |
| Resin | B | |
| Ramming masts | C | |
| Rivets | B | |
| Rapeseed | (1) | Do. |
| Rapeseed cakes | (1) | Do. |
| Rapeseed cake meal | (1) | Do. |
| Rapeseed oil | B | |
| Rags | B | |
| Rock salt | (1) | Do. |
| Rails, new | B | |
| Rails, old | C | |
| Retorts, of baked stone | B | |
| Retorts of glass | (2) | |
| Retorts, coal | C | |
| Reed, must be covered by shippers | B | |
| Reed, Spanish | B | |
| Rowing boats and the like | B | |
| Rye | (1) | Do. |
| Rattan | B | |
| Rushes | B | |
| Rice | (1) | Do. |
| Rice meal | (1) | Do. |
| Rope | B | |
| Refrigerators (for preparation of dairy products) | B | |
| Spelt | (1) | Do. |
| Spelt meal | (1) | Do. |
| Spools, of wood | B | |
| Sponges | (2) | |
| Spurry seed | (1) | Do. |
| Steel, old | C | |
| Steel, rough, in blocks | C | |
| Steel, in bars | B | |
| Steel wire | B | |
| Steel wares, including those of which the chief element consists of steel; unpolished, and not specially mentioned. | B | |
| Stone, manufactured (no sculpture) | B | |
| Stones, rough, not specially mentioned | C | |
| Stones, paving, polished or painted | B | |
| Stones, paving, unpolished or unpainted | C | |
| Stones, paving, marble | B | |
| Stone dust | C | |
| Salt, rock | (1) | Do. |
| Steam boilers, iron | B | |
| Straw, in pressed bales, must be covered by shippers. | B | |
| Straw, in unpressed bales, must be covered by shippers. | (2) | |
| Straw covers, in pressed bales | B | |
| Straw covers, in unpressed bales | (2) | The bales will be regarded as unpressed when they weigh less than 100 kilograms (220 pounds) per cubic meter (3 cubic feet). |
| Straw pulp, wet, for manufacture of paper | B | |
| Supports for coal mines | C | |
| Starch | B | |
| Skins, green, dried, or salted | B | |
| Seeds, forest, not specially mentioned | (1) | Transported in closed or covered cars. |
| Seeds, grass, not specially mentioned | (1) | Do. |
| Seeds, oil, not specially mentioned | (1) | Do. |
| Seeds, field | (1) | Do. |
| Seeds, black, as refuse of wheat | (1) | Do. |
| Sawdust | B | |
| Seeds, not specially mentioned | (1) | Do. |
| Sacks | B | |
| Sand | C | |
| Seaweed, in pressed bales, to be covered by shippers. | B | |
| Seaweed, in unpressed bales, to be covered by shippers. | (2) | |
| Sea salt | (1) | Do. |
| Salt, rock, sea, or kitchen | (1) | Do. |
| Salt, ammoniac | B | |
| Salt, Epsom | B | |
| Salto-acid | B | |
| Shoeblack | B | |
| Ship's anchors, iron | B | |
| Shells | C | |
| Shivers of glass | C | |
| Shivers of porcelain | C | |
| Shoes, old | B | |

[1] Exceptional tariff 2.

[2] Exceptional tariff 1.

*Classification of freight*—Continued.

| Article. | Class. | Remarks. |
|---|---|---|
| Schoolbenches, not wholly undone | (1) | |
| Screw bolts | B | |
| Screws, iron | B | |
| Sesame cakes | (2) | Transportation in closed or covered cars. |
| Sesame cakes, meal | (2) | Do. |
| Sesame meal | (2) | Do. |
| Sesame oil | B | |
| Sesame seed | (2) | Do. |
| Shoddy wool, in unpressed bales | (1) | The bales will be considered as unpressed when they weigh less than 100 kilograms (220 pounds) per cubic meter (3 cubic feet). |
| Sirup, beet root (molasses), unrefined | B | |
| Slags | C | |
| Silicate cotton | C | |
| Sleighs, of such measure that they can pass through the doors of a common baggage or closed goods van. | (1) | The freight as express goods has only to be paid when transportation with a specially designated train is desired. |
| Smear oil, mineral | B | |
| Soda, also crystal soda | (2) | Transported in closed or covered cars. |
| Strawberries | (2) | Do. |
| Sofas, skeletons of | (1) | |
| Staves | B | |
| Seeds | (2) | Do. |
| Skeletons of sofas | (1) | |
| Skeletons of chairs | (1) | |
| Stone gravel | C | |
| Shrubs, when they are not wrapped up in a manner that other articles may be loaded in the same car. | (1) | When a shipment does not cover more than half the surface of the bottom of the car, and a charge for 2,500 kilograms (5,500 pounds) is more in favor of the shippers, the freight will be calculated at the tariff for class A. Shrubs includes only those which are still provided with roots. Branches, etc., will not be considered as such, even though they may be for grafting. |
| Stoves, cast iron | B | |
| Stove black | B | |
| Spoons, wooden | B | |
| Stationary steam engines | B | |
| Sheet iron, not polished | B | |
| Scouring cotton | B | |
| Soot, as fertilizer | C | |
| Saltpeter (Chile), as fertilizer | C | |
| Saltpeter, crude and refined | B | |
| Tin plate, manufactures of, weighing less than 200 kilograms (440 pounds) per cubic meter (3 cubic feet). | (1) | |
| Trees, alive | (1) | When a shipment does not cover more than half the surface of the bottom of the car, and a charge for 2,500 kilograms (5,500 pounds) according to class A is more in favor of the shippers, this charge will be made instead of the charge according to the exceptional tariff 1. |
| Tree trunks | C | |
| Tree fruits, fresh, not specially mentioned (except oranges, citrons, grapes, and in general all kinds of green fruits and drugs). | (2) | |
| Tins | (1) | |
| Tan | C | |
| Turnips | C | |
| Tan cakes, must be covered by shippers | C | |
| Trunks, empty | (1) | Small hand trunks and those which are put into each other not included. |
| Tubs, empty | (1) | |
| Trolleys | B | To be charged for according to the real weight, whether they have been undone or not. |
| Trucks of carriages, cars, and baby carriages | (1) | |
| Tanks, iron | B | |
| Talc | B | |
| Tallow oil | B | |
| Twigs | B | |
| Tar | B | |
| Tar oil | B | |
| Tiles, polished or painted | B | |
| Tiles, unpolished or unpainted | C | |
| Tiles, marble | B | |
| Telephone cables | B | |
| Telephone posts | C | |
| Telegraph cables | B | |
| Telegraph posts | C | |
| Turpentine | B | |
| Turpentine oil | B | |

[1] Exceptional tariff 1.

[2] Exceptional tariff 2.

*Classification of freight*—Continued.

| Article. | Class. | Remarks. |
|---|---|---|
| Tilestone | C | |
| Timber, sawn | B | |
| Tuff, ground, to be covered by shippers | B | Transported in closed or covered cars. |
| Troughs of stone | C | |
| Tripoli | C | |
| Tuff | C | |
| Turf, covered by shippers | C | |
| Turf briquets, covered by shippers | C | |
| Turf coal, covered by shippers | C | |
| Turf litter, covered by shippers | C | |
| Turf fiber, covered by shippers | B | |
| Tricycles, not undone | (1) | As undone will be regarded only: Bicycles of which the handle bar, the pedals, and the saddle can be taken off at the same time, and tricycles of which the front or back wheels can be taken off the axle and tied up to the third wheel. |
| Twisted wares | (1) | |
| Tallow earth | B | |
| Tiles, of wood | B | |
| Vinegar, in casks | B | |
| Vetches | (2) | Transported in closed or covered cars. |
| Vegetables, fresh | (2) | Do. |
| Vegetable fiber, in pressed bales | B | |
| Vehicles, undone, when the different parts can pass through the doors of common 10-ton goods vans; if not, they will be charged for according to the tariff on vehicles. | (1) | Including the carriages of which only the wheel can be taken off. |
| Vitriol, copper | B | |
| Vitriol, iron | C | |
| Vitriol, zinc | B | |
| Vegetables, preserved in casks | B | |
| Vacuum machines of a measure that they can pass through the doors of a common two ton goods van and are mentioned as bulky goods; otherwise the freight will be charged according to the tariff on vehicles. | (1) | |
| Weaver's thistles | (1) | |
| Wire, steel | B | |
| Wire, iron | B | |
| Weights, iron | B | |
| Wood, sawn, carpenters' and shipbuilders' | B | |
| Wood, not sawn, not specially mentioned | C | |
| Wood, dye, in blocks or pieces | B | |
| Wood shavings | (1) | |
| Wood meal, must be covered by shippers | B | |
| Wood screws, iron | B | |
| Wood, chips, must be covered by shippers | B | |
| Wood, manufactures of | B | |
| Wooden shoes | B | |
| Wheelbarrows, both loaded or empty | (1) | |
| Wool, artificial, in unpressed bales | (1) | Bales will be considered as unpressed when they do not weigh more than 100 kilos (220 pounds) per cubic meter (3 cubic feet). |
| Wicker work | (1) | |
| Whetstones, common | C | |
| Wheat | (2) | Transported in closed or covered cars. |
| Whale oil, in barrels | B | |
| Windows and windowpanes, not painted or varnished. | B | May be painted with minium. |
| Weaver's combs, old | B | |
| Wagons, not fit to run on rails, undone, which are of such measure that they can pass through the doors of a 10-ton goods van; if this is not the case, the charge will be made according to the tariff for vehicles. | (1) | This also includes cars of which the wheels only can be removed. |
| Wagon grease | B | |
| Water glass | B | |
| Waddings | (1) | |
| Wood ash, must be covered by shippers | B | |
| Whey | B | |
| Oakum | (1) | |
| Whetstones | C | |
| Wheelbands, steel and iron | B | |
| Wheels, steel and iron | B | |
| Wool, in unpressed bales | (1) | The bales will be regarded as unpressed when they weigh less than 100 kilograms (220 pounds) per cubic meter (3 cubic feet). |
| Zinc, in blocks | B | |
| Zinc ore | C | |
| Zinc vitriol | B | |

[1] Exceptional tariff 1.

[2] Exceptional tariff 2.

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# RAILWAY FREIGHT RATES, INLAND WATERWAYS, AND CANALS OF GERMANY

REPORT BY

A. M. THACKARA

AMERICAN CONSUL GENERAL AT BERLIN

SUPPLEMENTED BY REPORTS FROM OTHER CONSULAR OFFICERS IN GERMANY

WASHINGTON

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# RAILWAY FREIGHT RATES, INLAND WATERWAYS, AND CANALS OF GERMANY.

By A. M. THACKARA, *American Consul General at Berlin.*

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This report is in answer to questions prepared by the National Waterways Commission and the Department of Commerce and Labor and transmitted to American consuls through the Department of State.

## CHAPTER I.

### QUESTIONS RELATING TO FOREIGN RAILWAY RATES SUBMITTED BY THE NATIONAL WATERWAYS COMMISSION THROUGH THE DEPARTMENT OF STATE.

I. Give ten examples of rates on coal on different railway lines for different distances, with the following details:

(*a*) Give termini for each shipment.

(*b*) Give distances of each shipment, including in the list of ten rates at least three rates for the maximum distance that coal is shipped.

(*c*) Give separately the terminal and transportation charge. (If this is not possible, make note of the fact that the two are combined.)

(*d*) State what service is covered by the terminal charge.

(*e*) State the class of rate into which the coal traffic falls; that is, whether the rate is a special or commodity rate or a normal class rate, and, if the latter, what class.

(*f*) Give all other facts concerning method of shipment which affect the rate, such, for example, as minimum carload weight or minimum train load, open or closed cars, fast or slow freight, and the like.

(*g*) If any of these rates have been given to encourage the development of any industry, state the facts.

II. Answer the above seven questions (*a* to *g*), quoting in each case ten examples of rates on different railway lines for different distances for the following commodities: 1, iron ore; 2, stone; 3, lumber; 4, fertilizer; 5, grain.

III. Give ten illustrations of special rates granted to export business on different railways for different distances, and answer in each case the questions propounded above for the coal traffic (*a* to *g*) so far as they are applicable to the export business. Make a statistical tabulation comparing these export rates with local rates between the same termini.

IV. Give ten illustrations of rates charged by different railways for different distances on the highest grade of classified freight, that which, in many countries, corresponds to the express business of the United States, and answer in each case the questions propounded for the coal traffic (*a* to *g*).

V. Give ten illustrations of rates charged by different railways for different distances on typical products included in the various categories of the regular freight classification, showing both carload and less than carload rates, and answer in each case the questions propounded for the coal traffic (*a* to *g*).

VI. Are the freight rates based absolutely on distance, or is the rate per ton-mile less for longer distances? Show, in the case of different commodities, at what distances the fall in the rate per ton-mile takes place.

## Chapter II.

### QUESTIONS SUBMITTED BY THE DEPARTMENT OF COMMERCE AND LABOR THROUGH THE DEPARTMENT OF STATE RELATIVE TO RIVERS AND CANALS IN FOREIGN COUNTRIES.

#### I.—PUBLIC SUPERVISION.

(*a*) State what public authority, national, state, or local, exercises supervision in the different instances over navigable streams and canals.

(*b*) What are the powers and duties of such officials in regard to the following:

(1) Capitalization of navigation corporations.
Regulation of freight rates.
Reports of operation.
Maintenance and improvement of channels, docks, and terminal facilities.

(2) Collection of statistics of water-borne traffic, and by what agencies such statistics are compiled and published.

#### II.—WATERWAY IMPROVEMENTS.

(*a*) Is there any established policy as to water powers developed by works constructed for improving navigation? Give illustrations.

(*b*) To what general extent have river improvements and the construction of canals been carried on by the Central Government, by local governments, and by private enterprise? Give typical and important illustrations of each. Describe any system of cooperation and contribution between the Central Government and local government in such works.

#### III.—FLOATING EQUIPMENT.

(*a*) What is the general character of vessels used on rivers and canals?

(1) The relative use of self-propelled vessels and towed vessels.
(2) Motive power for barges and canal boats.
(3) Size and draft of vessels.
(4) The use of iron, steel, and wood in vessel construction.
(5) The cost of various types of boats.
(6) The use of special types of boats for particular cargoes and on different classes of waterways.
(7) The size of fleets of barges.
(8) Is the type of boats adapted to low-water stages, or are they constructed with a view to utilization in high water?

In each case specific information is desired showing the situation in typical instances rather than general statements of a summary character.

#### IV.—OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

(*a*) Do canal companies or other waterway improvement companies own and operate vessels? Give examples.

(*b*) Are there important cases of consolidation of vessel owners into large corporations operating extensive fleets on inland waterways?

(*c*) To what extent are vessels owned and operated by railroads, or by producing and distributing concerns, such as coal, oil, lumber, ore, etc., fleets? Give examples.

(*d*) Are there any fleets of merchant vessels owned and operated by public authorities? Give examples.

(*e*) Are there important instances of combinations or monopolies controlling towing on canals and rivers? Give examples.

#### V.—TERMINAL FACILITIES.

(*a*) What are the important or striking physical features of river and canal terminals, such as docks, wharves, piers, and floating wharf boats? Give illustrations and send photographs with this answer.

(*b*) Describe the most advanced methods of loading and unloading vessels on inland waterways, including the use of mechanical appliances.

(*c*) Are railroad tracks located on terminals of inland waterways, permitting direct transfer between railroad and water lines? Do such railroad tracks form a belt railroad, connecting all the railroads at a given port? Give examples.

(*d*) Are river and canal terminals owned by public or private interests? Are they owned at all by private railways? If so, give the important instances.

### VI.—TOLLS AND FREIGHT RATES.

(*a*) Are tolls charged on canals and rivers? If so, what elements are considered in framing them and what service do they cover? Are there separate tolls for boats and cargo? Give typical illustrations.

(*b*) What elements enter into the making of towing rates on canals and rivers? Give illustrations of towing charges and send copies of any tariffs or towing rates.

(*c*) Do inland water lines have regular schedules of freight rates and classifications of freight? Are the rates stable or do they vary frequently with traffic exigencies? Give illustrations.

(*d*) How are inland waterway rates affected by—

(1) Distance of haul?
(2) Quantity of commodity offered?
(3) Speed?
(4) Character of commodity?

Give illustrations on important waterways.

(*e*) Do prorating arrangements exist between water lines and railroads, and to what extent? Give illustrations and send copies of joint rail and water tariffs.

(*f*) How do inland water rates affect railroad freight rates? Are railroad freight rates to water competitive points higher than to interior nonwater points of similar distances? Give illustrations.

Compare inland water rates with paralleling railway rates for short and for long distances, giving specific illustrations which shall show whether waterways have greater competitive power in the one case than in the other.

(*g*) What is the general attitude of rail and water lines toward each other? Is there active competition or are there agreements for the division of traffic? Give examples.

(*h*) Is there any legislation regulating the relations between rail and inland waterway systems of transportation? Is there any governmental restriction on the lowering of rail rates in competition with water rates? Give examples.

(*j*) Is it customary for shippers of goods by inland waterways to insure them, or is the risk assumed by the carrier? To what extent does this affect the freight rate? Give examples.

### VII.—WATER-BORNE TRAFFIC.

(*a*) What is the general character of traffic on inland waterways: The principal commodities moved, the proportion and character of traffic moved in different directions, relative importance of package and bulk freight, etc. (This should be answered specifically for different waterways.)

(*b*) Send official publications giving, for the last ten years, available statistics of vessel movement and traffic carried on inland waterways; also railroad traffic, tonnage, and ton-mileage.

(*c*) Taking important inland water routes, does local traffic or other traffic predominate, and in what general proportion?

(*d*) Give a concise statement of typical conditions of labor which is employed in navigation and in terminal handling, particularly with reference to wages paid.

NOTE.—The above questions were revised by the members of the National Waterways Commission.

## Chapter I.

# RAILWAY FREIGHT RATES OF GERMANY.

Since the foundation of the German Empire the policy of the Imperial and state governments has been to secure the unification of the tariff rates and uniformity in the administrative regulations of the railroads of Germany, on the principle that the highest interests of the nation would thereby to a greater extent be protected.

The steady movement toward uniform freight rates throughout this country has been facilitated by the fact that less than 9 per cent of the entire railway mileage of the Empire is under private control.

In Prussia the mileage of the state-owned railways in 1907 was 31,846 kilometers (19,788 miles), as compared with 2,165 kilometers (1,345 miles) in the possession of private corporations.

In certain parts of Germany the private lines are fairly numerous, but each of limited mileage. They do not as a rule form any part of the through communication, but are in general contributory lines or serve the local traffic of a small district.

In Saxony the railways are wholly state except a few miles (6 miles) of private lines connecting with mines.

In Bavaria now that the state ownership of the Palatinate Railway was secured on January 1, 1909, private lines form but a small part of the internal means of communication and their ultimate absorption by the state is only a question of time. There are 7,267 kilometers (4,515 miles) of railways belonging to the states, as compared with 267 kilometers (166 miles) of private roads.

In Württemberg there are 1,708 kilometers (1,061 miles) of state-owned railways and 143 kilometers (89 miles) of private lines.

In Baden there are 1,781 kilometers (1,107 miles) of state and 227 kilometers (141 miles) of private railways.

In Alsace-Lorraine there are 1,732 kilometers (1,076 miles) of state and 16 kilometers (10 miles) of private railways.

In the whole of Germany there are 53,016 kilometers (32,943 miles) of state-owned railways and 3,510 kilometers (2,181 miles) of private-owned.

The above information refers to railways having the normal gauge—1,435 meters (4,693 feet)—and does not include the narrow-gauge railways.

The full-gauge railways of Germany are divided into two classes—the trunk lines (Hauptbahnen) and the feeders, connecting railways, local railways, etc. (Nebenbahnen). The latter may form a part of a through-rate route, or in other words taking the generally accepted system for the compilation of rates, i. e., by the shortest mileage,

when there is a route with a "Nebenbahn" as intermediary, that route is usually taken into account for the transportation charges. It may also happen that the development of the traffic eventually results in a "Nebenbahn" being classed as a trunk line, in which case the regulations applying to the latter must be observed.

In addition to the above full-gauge railways there are the full and narrow gauge lines not used by the general public, such as mining, industrial, agricultural, and forest lines. Under these are included lines connecting with private establishments, providing the terminus is not noted in the tariff and does not serve for public use.

There are also lines which possess a purely local character, such as street railways for the carriage of passengers and interurban branch roads resembling street railways in character, construction, and management, but designed for the carriage of freight between neighboring localities.

For the purposes of this report the railway rates considered are only those of the state-owned railways, as the rates in force on the private railways, while varying more or less from the regular rates, are to a great extent calculated on the same general principles.

The administration of the railways and the supervision of the private lines are left to each Federal State.

The state railways, however, in Germany are practically all under the same method of control, with variations in the title of the officials or office at the head. The official head of the Prussian state railways is the minister of public works. In him is vested large powers of administration, and he has wide authority in supervising the expenditures of the amounts appropriated by the Parliament. In addition there are also various supervisory authorities.

The upper house of Parliament (Bundesrath) is the authority responsible for the regulations in connection with the transport of passenger and freight traffic and the regulations dealing with the construction and working of the railways. The executive office of the Bundesrath is the imperial railway department (Reichs-Eisenbahn Amt), which consists of a president and a requisite number of members, the seat being in Berlin Its duties are to exercise supervision over railway matters; to see that the provisions of the constitution of the German Empire as well as all other laws and constitutional enactments pertaining to railways are enforced, and, after obtaining information from the various railway administrations, or by personal inquiry, to take the necessary measures to remedy any defects or abuses occurring in the railway systems. This office also prepares questions for the consideration of the Bundesrath in so far as they relate to railway matters.

For the elaboration of the traffic regulations in detail form for the guidance of officers and employees there is the German Railroad Traffic Association (Deutscher Eisenbahn Verkehrs Verband). Although the activity of this association is chiefly confined to internal railway matters, it also deals with the regulations for the dispatch of freight and the regulations for the conveyance of articles. There are 79 ordinary and 15 extraordinary members of the association, the membership consisting of the various railway managements in Prussia and of private and other state railways in Germany.

For the regulations regarding the tariffs of freight rates there is the "General Conference," composed of all of the railways of the German Empire, convened by the Prussian minister of public works, meetings being held as a rule once a year. The following come within the province of the conference: The general supplementary traffic regulations, the general tariff regulations, freight classification, and subsidiary charges.

The number of votes to which each railway represented in the conference is entitled is as follows: Up to 50 kilometers (31 miles), 1 vote; above 50 and up to 150 kilometers (93.2 miles), 2 votes; above 150 and up to 300 kilometers (186.4 miles), 3 votes; above 300 and up to 500 kilometers (310.7 miles), 4 votes; and for every additional 200 kilometers (124.3 miles), 1 vote more.

The decisions of the conference are binding if they are passed unanimously, otherwise they become effective if within the space of four weeks they have not been negatived by such a number of railway managements as represent at least one-fifth of the entire voting power of the conference. The approved decisions must be carried out by all the railways belonging to the conference on an appointed date, usually on the 1st day of April following the meeting of the general conference.

For the preparation of the business of the general conference there exists a permanent tariff commission, which on April 1, 1908, consisted of representatives from 14 of the leading railway boards. Forming a part of the permanent commission is a traders' committee, representing the interests largely dependent upon railway transportation. Its membership consists of five representatives of agriculture elected by the combined chambers of agriculture, five representatives of manufacturing interests, five representatives of commerce elected by the combined chambers of commerce and industry, and one member appointed by the Bavarian Government.

The following are the matters which may be referred to the tariff commission by any railway affiliated with the general conference or by the traders' committee: The general supplementary traffic regulations, the general tariff regulations, and freight classification.

The discussions take place in meetings of both the tariff commission and the traders' committee. Matters belonging to passengers and baggage are dealt with by the tariff commission alone. Meetings are held in February, June, and September. Reports of the meetings containing the decisions arrived at, excepting those relating to passengers and baggage, are submitted to the railways forming the general conference and to each member of the traders' committee and his deputy. A quorum consists of at least 10 of the representatives of the railways and 7 of the traders. Resolutions are passed by the majority of the votes.

There is also the Association of German Railway Administrations (Verein Deutscher Eisenbahn Verwaltungen), which comprises the majority of railways in Germany, Holland, Luxemburg, and Roumania. The administration of the Austrian-Hungarian, of two of the larger Russian railroads, and of one small Belgian railroad are also members of this association. Its authority deals principally with the working regulations for the interchange of traffic between

the various railways concerned; that is, regulations as to the conveyance of passengers and freight and the mutual obligations and duties of railways and the persons making use of the same, car demurrage, etc.

For the general consideration of questions regarding the railway tariffs, with the exception of the classification of freight, advisory councils, called district advisory councils, assist the different railway managements. There is also a general advisory council for the assistance of the minister of public works.

In Prussia all the members of the district advisory councils and three-quarters of the members of the general council are chosen voluntarily, the remainder being nominated by the minister. The members of the councils are also chosen independently in Oldenburg, Württemberg, and Hesse. In Baden and Saxony, in addition to the members elected voluntarily, the minister also appoints a certain minority. In Bavaria all the members are appointed by the crown on the recommendation of the various economic bodies.

In Prussia the councils differ from those of other States in certain important points, in that they are created by act of Parliament, whereas elsewhere they are appointed by the Crown or the chief minister, and in Prussia there are two distinct bodies, the councils for the district managements and the general council to assist the minister, whereas in other States there is only a single council for the central administration.

In Prussia the district councils are composed of representatives of commerce, industry, agriculture and forestry. The members, as also their deputies in case of members being prevented from attending, shall be elected for three years by the chambers of commerce, merchants' associations, agricultural provincial unions, and other associations and unions of commerce and trade, and of agriculture and forestry to be designated by the ministers of public works. The number of members and deputies, as also their proportionate distribution among the various interested bodies, shall be decided by the above-mentioned ministers.

The general advisory council shall consist of a president and his deputy, nominated by the King for three years: three members and deputies appointed by the minister of agriculture and forestry; three members appointed by the minister of commerce and trade; two members appointed by the minister of finance; two members appointed by the minister of public works; one member for the government districts of Cassel and Wiesbaden; one member for each of the cities of Berlin and Frankfort on the Main; two members for each of the provinces of East Prussia, West Prussia, Pommerania, Brandenburg, Schleswig-Holstein, Hanover; three members for each of the provinces of Silesia, Saxony, Westphalia, and the Rhineland, and a like number of deputies.

As regards non-Prussian States of the Empire whose territory is crossed or surrounded by the Prussian-Hessian state railways to any great extent, representatives of commerce, industry, agriculture, and forestry may be admitted if their respective associations express a desire to this effect and the sanction of their respective governments is obtained. They are elected by the district advisory councils for a period of three years. Special experts may be called in to give in-

formation on certain matters at the discretion of the minister of public works.

The councils are only advisory in the true sense of the word, having no authority whatever over the railway administrations, although the latter prepare all the data necessary for the discussion of the questions brought before the district councils. The secretary of the council is a railway official and the chairman is the president of the state railway management concerned, but he and any other railway officials attending the meetings as experts have no vote.

The matters brought before the general advisory council are of the same general character as those handled by the district councils, but of greater national importance.

The councils, after investigation and discussion of the various questions, can only submit their recommendations to the proper officials.

## TARIFF RATES.

Railroad freight rates in Germany are based on a scheme of kilometric rates for different classifications of goods and for fast and slow services, varying it may be in different States slightly in amount, but not in principle.

In the following table is indicated the basis on which the rates for the general freight traffic of the Prussian railway systems are calculated. The freight is divided into nine general classes. For each class there is a distinct rate per ton per kilometer (0.621 mile), diminishing in some classes with the increase of the distance. For each class there is a distinct rate for terminal charges, for distances exceeding 100 kilometers (62.1 miles), materially lessened for distances under 100 kilometers. With slight unimportant changes the same basis is used by the other States.

*Normal tariff rates.*

| Distance. | Not in carloads. | | | | | |
|---|---|---|---|---|---|---|
| | Fast freight. | | General freight. | | Special tariff for certain specified goods. | |
| | Rate per (metric) ton-kilometer. | Rate per (short) ton-mile. | Rate per (metric) ton-kilometer. | Rate per (short) ton-mile. | Rate per (metric) ton-kilometer. | Rate per (short) ton-mile. |
| | *Pfgs.* | *Cts.* | *Pfgs.* | *Cts.* | *Pfgs.* | *Cts.* |
| Less than 50 kilometers (31 miles) | 22 | 7.6 | 11 | 3.8 | ..... | ..... |
| 51–200 kilometers (124 miles) | 20 | 6.9 | 10 | 3.5 | ..... | ..... |
| 201–300 kilometers (186 miles) | 18 | 6.2 | 9 | 3.1 | ..... | ..... |
| 301–400 kilometers (249 miles) | 16 | 5.5 | 8 | 2.8 | ..... | ..... |
| 401–500 kilometers (311 miles) | 14 | 4.8 | 7 | 2.4 | ..... | ..... |
| Over 500 kilometers (311 miles) | 12 | 4.2 | 6 | 2.1 | ..... | ..... |
| For all distances | ..... | ..... | ..... | ..... | [1]8 | [1]2.8 |
| Terminal charges for each $\frac{1}{10}$ metric ton or fraction of same, in pfennigs: | | | | | | |
| 1–10 kilometers (6.2 miles) | 20 | ..... | 10 | ..... | ..... | ..... |
| 11–20 kilometers (12.4 miles) | 22 | ..... | 11 | ..... | ..... | ..... |
| 21–30 kilometers (18.6 miles) | 24 | ..... | 12 | ..... | ..... | ..... |
| 31–40 kilometers (24.9 miles) | 26 | ..... | 13 | ..... | ..... | ..... |
| 41–50 kilometers (31.1 miles) | 28 | ..... | 14 | ..... | ..... | ..... |
| 51–60 kilometers (37 miles) | 30 | ..... | 15 | ..... | ..... | ..... |
| 61–70 kilometers (43 miles) | 32 | ..... | 16 | ..... | ..... | ..... |
| 71–80 kilometers (49 miles) | 34 | ..... | 17 | ..... | ..... | ..... |
| 81–90 kilometers (56 miles) | 36 | ..... | 18 | ..... | ..... | ..... |
| 91–100 kilometers (62 miles) | 38 | ..... | 19 | ..... | ..... | ..... |
| Over 100 kilometers | 40 | ..... | 20 | ..... | ..... | ..... |

[1] The rate for general freight is applicable for distances greater than 726 kilometers (456 miles).

*Normal tariff rates*—Continued.

| Distance. | Carloads. | | | | Special tariffs. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | A1. | | B. | | A2. | | I. | | II. | | III. | |
| | *Pfgs.* | *Cts.*[1] | *Pfgs.* | *Cts.*[1] | *Pfgs.* | *Cts.*[1] | *Pfgs.* | *Cts.*[1] | *Pfgs.* | *Cts.*[1] | *Pfgs.* | *Cts.* |
| For all distances | 6.7 | 2.3 | 6 | 2.1 | 5 | 1.7 | 4.5 | 1.6 | 3.5 | 1.2 | ..... | ..... |
| 1–100 kilometers (62.1 miles) | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.6 | 0.9 |
| Over 100 kilometers | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.2 | .7 |
| Terminal charges for each $\frac{1}{10}$ metric ton or fraction of same, in pfennigs: | | | | | | | | | | | | |
| 1–10 kilometers (6.2 miles) | ..... | ..... | 8 | | | | | | | | | |
| 11–20 kilometers (12.4 miles) | ..... | ..... | 9 | | | | | | | | | |
| 21–30 kilometers (18.6 miles) | ..... | ..... | 10 | | 6 | ..... | 6 | ..... | 6 | ..... | 6 | ..... |
| 31–40 kilometers (24.9 miles) | ..... | ..... | 11 | | | | | | | | | |
| 41–50 kilometers (31.1 miles) | ..... | ..... | 12 | | | | | | | | | |
| 51–60 kilometers (37 miles) | ..... | ..... | 12 | | | | | | | | | |
| 61–70 kilometers (43 miles) | ..... | ..... | 12 | | | | | | | | | |
| 71–80 kilometers (49 miles) | ..... | ..... | 12 | | 9 | ..... | 9 | ..... | 9 | ..... | 9 | ..... |
| 81–90 kilometers (56 miles) | ..... | ..... | 12 | | | | | | | | | |
| 91–100 kilometers (62 miles) | ..... | ..... | 12 | | | | | | | | | |
| Over 100 kilometers | ..... | ..... | 12 | ..... | 12 | ..... | 12 | ..... | 12 | ..... | 12 | ..... |

[1] Rate per short ton-mile.

The application of the above table is readily seen from a few examples. It is required to establish the rate for 100 kilograms of general freight from Berlin to Chemnitz, a distance of 220 kilometers (136.4 miles).

For the first 50 kilometers the rate in the table is 11 pfennigs per ton-kilometer. For the next 150 kilometers it is 10 pfennigs. For the remaining 20 kilometers it is 9 pfennigs.

The calculation is as follows: One hundred kilograms equals one-tenth of a ton, and the rates in column "General freight" are hence to be divided by ten.

| | Marks |
|---|---|
| Transport, 50 by 1.1 | 0.55 |
| Transport, 150 by 1 | 1.50 |
| Transport, 20 by 0.9 | .18 |
| Terminal charge, 100 kilometers | .20 |
| Total | 2.43 |

Again, the rate is required for 15 tons of freight falling under the Class III of Special Tariffs, from Berlin to Chemnitz. The rate is 2.2 pfennigs per ton-kilometer, or—

| | Marks |
|---|---|
| Transport, 2.2 by 220 by 15 | 72.60 |
| Terminal charges, 15 by 10 by 12 | 18.00 |
| Total | 90.60 |

In order to save calculations such as the above, a table has been compiled called the "Allgemeine Kilometer Tariftabelle," giving the total freight rate, including transport and terminal charges, for each class of freight for all distances from 1 to 1,600 kilometers.

The following abridgment of the table in question affords a fair view of its essential features. The various rates are given for each even hundred kilometers, and also for each 10 kilometers of the first 100 kilometers. The rates are in marks per metrical ton for the kilometer distances. In the final column the rates for general freight not in full carloads are also given in terms of dollars per short ton of 2,000 pounds per mile for the purpose of affording an easy comparison with current American freight rates.

It might be noted that any rate in the following table can be transformed into dollars per short ton-mile if the amount be divided by the distance in kilometers and multiplied by the factor 0.347.

*General tariff for freight transported throughout Germany.*

[Rates per metric ton of 2,204.62 pounds for the following distances, inclusive of terminal charges.]

| Kilometers.[1] | Fast freight. | General freight. | Special tariff for certain specified goods. | Special tariffs. | | | | | | Freight per ton-mile (short tons). |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A1. | B. | A2. | I. | II. | III. | |
| | *Marks.* | *Marks.* | *Marks.* | *Marks.* | *Marks.* | *Marks.* | *Marks.* | *Marks.* | *Marks.* | |
| 10 | 4.2 | 2.1 | 1.8 | 1.7 | 1.4 | 1.1 | 1.1 | 1.0 | 0.9 | $0.0729 |
| 20 | 6.6 | 3.3 | 2.7 | 2.4 | 2.1 | 1.6 | 1.5 | 1.3 | 1.1 | .0572 |
| 30 | 9.0 | 4.5 | 3.6 | 3.2 | 2.8 | 2.1 | 2.0 | 1.7 | 1.4 | .0520 |
| 40 | 11.4 | 5.7 | 4.5 | 4.0 | 3.5 | 2.6 | 2.4 | 2.0 | 1.6 | .0485 |
| 50 | 13.8 | 6.9 | 5.4 | 4.8 | 4.2 | 3.1 | 2.9 | 2.4 | 1.9 | .0478 |
| 60 | 16.0 | 8.0 | 6.3 | 5.5 | 4.8 | 3.9 | 3.6 | 3.0 | 2.5 | .0461 |
| 70 | 18.2 | 9.1 | 7.2 | 6.3 | 5.4 | 4.4 | 4.1 | 3.4 | 2.7 | .0451 |
| 80 | 20.4 | 10.2 | 8.1 | 7.1 | 6.0 | 4.9 | 4.5 | 3.7 | 3.0 | .0441 |
| 90 | 22.6 | 11.3 | 9.0 | 7.8 | 6.6 | 5.4 | 5.0 | 4.1 | 3.2 | .0434 |
| 100 | 24.8 | 12.4 | 9.9 | 8.6 | 7.2 | 5.9 | 5.4 | 4.4 | 3.4 | .0428 |
| 200 | 45.0 | 22.5 | 18.0 | 15.4 | 13.2 | 11.2 | 10.2 | 8.2 | 5.6 | .0390 |
| 300 | 63.0 | 31.5 | 26.0 | 22.1 | 19.2 | 16.2 | 14.7 | 11.7 | 7.8 | .0364 |
| 400 | 79.0 | 39.5 | 34.0 | 28.8 | 25.2 | 21.2 | 19.2 | 15.2 | 10.0 | .0342 |
| 500 | 93.0 | 40.5 | 42.0 | 35.5 | 31.2 | 26.2 | 23.7 | 18.7 | 12.2 | .0318 |
| 600 | 105.0 | 52.5 | 50.0 | 42.2 | 37.2 | 31.2 | 28.2 | 22.2 | 14.4 | .0304 |
| 700 | 117.0 | 58.5 | 58.0 | 48.9 | 43.2 | 36.2 | 32.7 | 25.7 | 16.6 | .0290 |
| 800 | 129.0 | 64.5 | 64.5 | 55.6 | 49.2 | 41.2 | 37.2 | 29.2 | 18.8 | .0280 |
| 900 | 141.0 | 70.5 | 70.5 | 62.3 | 55.2 | 46.2 | 41.7 | 32.7 | 21.0 | .0272 |
| 1,000 | 153.0 | 76.5 | 76.5 | 69.0 | 61.2 | 51.2 | 46.2 | 36.2 | 23.2 | .0265 |
| 1,100 | 165.0 | 82.5 | 82.5 | 75.7 | 67.2 | 56.2 | 50.7 | 39.7 | 25.4 | .0260 |
| 1,200 | 177.0 | 88.5 | 88.5 | 82.4 | 73.2 | 61.2 | 55.2 | 43.2 | 27.6 | .0256 |
| 1,300 | 189.0 | 94.5 | 94.5 | 89.1 | 79.2 | 66.2 | 59.7 | 46.7 | 29.8 | .0252 |
| 1,400 | 201.0 | 100.5 | 100.5 | 95.8 | 85.2 | 71.2 | 64.2 | 50.2 | 32.0 | .0249 |
| 1,500 | 213.0 | 106.5 | 106.5 | 102.5 | 91.2 | 76.2 | 68.7 | 53.7 | 34.2 | .0246 |
| 1,600 | 225.0 | 112.5 | 112.5 | 109.2 | 97.2 | 81.2 | 73.2 | 57.2 | 36.4 | .0244 |

[1] 1 kilometer = 0.621 mile.

In the above table there are two general categories depending upon whether or not goods are despatched in complete carloads. The freight is classed under nine different heads:

I. SHIPMENTS NOT MADE IN CARLOADS.

1. *Fast freight.*—This class includes articles sent at the discretion of the railway authorities either by regular, passenger, or by fast-freight trains. The rates are double those charged for ordinary freight. When freight is sent in complete carloads it pays double the rate prescribed for complete carloads of the classes A1 and B.

Special fast freight pays double the regular rates of fast freight in less than carload lots and the quadruple of the rates classed A1 and B for carloads. It is forwarded by the first train available and has preference over all other freight.

2. *General freight.*—In this class falls the great bulk of the freight not delivered in carloads by the consignor. Very light and voluminous goods, such as furniture, baskets, feathers, barrels, trees and shrubs, unbaled hay, hops, straw, wool and bark are charged 50 per cent above the regular rate.

In most German cities much of the merchandise which would be naturally included in this class is now actually despatched under the lower tariff for carloads. A shipper sending a few packages to

any important city, unless the case is urgent, delivers them to a general forwarding agent, who collects from various firms enough freight destined to the point in question, so that he can despatch an entire carload at frequent intervals, and his customers can profit by the lower rate.

There exist also lists of specified articles which are forwarded by fast freight at slow-freight rates, whether the goods are consigned in carload lots or in less quantities. These are for the most part perishable wares, such as bees, certain kind of vegetables, butter, fish of various descriptions, shellfish, milk and cream, fresh berries, grapes, etc.

3. *Special freight.*—Articles in this class are carried at a reduced rate, as is shown in the table. It includes goods of low value, such as bicycles, motor cycles, fertilizers, forage and other food for animals, grain of all descriptions, clover, machinery and agricultural implements, metals and metal wares, scrap metal, oil cake, mineral salts, drainpipes, peat, etc. The low rate of the tariff for this class becomes equal to that for ordinary freight for distances greater than 726 kilometers (456 miles).

If any of the specified articles enumerated above are entered with other articles on a fast-freight waybill, the whole consignment will be charged at the fast-freight rate unless, the weights being entered separately, it is found that it would be cheaper to charge freight separately.

In the case of consignments of fast freight in less than carload lots such separate calculation will only be made if the goods of the special tariff for specified goods and the other goods are delivered in separate packing.

### II. SHIPMENTS IN COMPLETE CARLOADS.

When goods are shipped with a minimum weight of 5 or 10 metric tons per car the following tariff rates for complete carloads become operative:

4. (A1) General freight in carloads of from 5 to 10 tons.

5. (B) General freight in carloads of 10 tons or more. These two classes include all freight not provided for in special tariffs.

6. (A2) The rates of this tariff apply to freight listed in Special Tariffs I and II, but shipped in quantities of less than 10 metric tons and over 5 tons. The rate for 5-ton consignments of such goods as are included in Special Tariff III is the 10-ton rate for Special Tariff II.

7. *Special Tariff I.*—This comprises raw cotton, iron and steel wares of all descriptions, asbestos, lead, raw skins and hides, glass, chalk, dyewoods, grain, certain kinds of wood, wood wares, seeds, malt, flour, paper, waste woolen products, and some other similar articles shipped in carloads of at least 10 tons.

8. *Special Tariff II.*—In this class are found asphalt, flax, hemp, wood, hops, cut stone, bone black, earthenware, sawdust, paper (for export) and the like, wood from middle Europe, structural iron and iron pipe, minimum weight 10 tons. This tariff also includes all goods listed under Special Tariff III shipped in quantities of from 5 to 10 tons.

9. *Special Tariff III.*—This applies to waste cotton products for the manufacture of paper, etc., waste woolen products for the manufacture of pasteboard wares, waste coal-tar products, waste tin products, waste products containing iron oxide and other metallic oxides, such as aniline oil, etc., trees and shrubs, bark, pig iron, ores, earths, potatoes, railway ties, bones, rags, heavy oils, oil cake, wood and coal, hay, hats, timber from middle Europe, minimum weight 10 tons.

As a rule German freight cars have a carrying capacity of 10, 12½, and 15 tons. There are also specially constructed cars which are used for special kinds of freight, among which are the ore cars, which have a capacity of 40 tons.

Ordinary freight cars have a floor space of from 15 to 18 square meters (161.4 to 193.7 square feet); there are also those having a floor space of from 21 to 25 square meters (226 to 269 square feet), which can be obtained upon special request.

The calculation of freight for carloads is based on a minimum weight of 10 tons and 5 tons, as the case may be, for each car used even though the actual weight be less than 10 tons and 5 tons respectively. For shipments of less than 10 tons but more than 5 tons, freight will be calculated on the actual weight at the five-ton rate or on 10 tons at the rate for that class for each car used, whichever calculation works out the cheaper.

If for one waybilled shipment, piece goods and carload rates are calculated separately, the piece-goods rates must be calculated on a minimum weight of 10 kilograms (22 pounds). In other respects the regulation relating to carloads are applicable. The railway administration has the right to utilize any space in the car if such space has not been used to full advantage by the shipper, or if the loading weight has not been exceeded.

Casks, vats, barrels. metal casks, metal cylinders (for the conveyance of spirits, chemicals, oil, varnishes), tin boxes, metal cake boxes, bottles, jugs, boxes, straws, etc., for packing, sacks, etc., when shipped as piece goods, freight on half the actual weight will be calculated in accordance with the bases of the general piece-goods class with a minimum as for 20 kilos (44 pounds), unless in the case of empties used when filled for the transportation of articles coming under the category of the special tariffs for specified piece goods, freight calculated on the full weight in accordance with the bases for this tariff is cheaper.

### EXCEPTIONAL TARIFFS.

The above classes do not include all current rates. There are other exceptional tariffs (Ausnahme tarife) which vary considerably both as regards the kilometric rate and the terminal charges. These rates are especially low to further important economic interests affecting sometimes the Empire at large, but more frequently individual States and sections.

The objects, as publicly announced, in forming such exceptional tariffs, were:

1. The advancement of the internal industrial and agricultural production by cheapening the cost of raw materials or needed equipments.

2. To facilitate the export of German wares.

3. To support the trade of German commercial centers, and more especially the seaports, against foreign competition.

4. To favor German railway lines against the competition of foreign railroads and also of foreign waterways.

The exceptional tariffs are in the main based on political or national considerations, and in practice are only granted when by so doing there is no danger of injury being caused to internal economic interests or when this concession would appear to be rendered necessary by such important considerations as those above mentioned.

At the present time there are 27 classes of exceptional tariffs in force, most of which have subdivisions. There are also 31 classes of seaport exceptional tariffs to encourage the export trade.

For example, exceptional rates have been granted by the Prussian State railways for the conveyance of grain traffic from Russia to over-sea countries (Sweden, Norway, England, etc.) and the rate per ton-kilometer from the frontier to the German harbors Königsberg, Danzig, etc., is lower than the rate for German grain between the same points. The rate per ton-kilometer from the frontier to Königsberg is 2.5 pfennigs (0.595 cent) including half the terminal charge as against 4 pfennigs (0.952 cent) for local grain between the same points. A special tariff is granted for the grain traffic from Hungary to England; for grain intended for export via Hamburg a special rate is given from the frontier to Hamburg, which is less by 115 marks ($27.37) for carloads of 10 tons than the local rate between the same points, 353 marks ($84.01) as against 468 marks ($111.38). These reduced rates have been instituted owing to the competition of the Belgian, Dutch, and French harbors and the Rhine shipping trade and by the Adriatic harbors and the Elbe shipping trade as regards Austria.

For minerals, petroleum, naphtha from the North Sea harbors and Lübeck, Stettin, and Swinemünde to South West Germany, Bavaria, Switzerland, Austria-Hungary, and vice versa direct preferential rates have been introduced by which the rate per ton-kilometer for the Prussian State Railway section, varies for carloads of Class B from 4 pfennigs (0.95 cent) to 2.2 pfennigs (0.52 cent) as against 6 pfennigs (1.428 cents) for the local traffic between the same points.

From Sosnowice in Russian Poland to Bavaria, Saxony, and Prussian stations there is a reduced rate for lubricating oil varying from 5.28 pfennigs (1.257 cents) to 1.88 pfennigs (0.45 cent) per ton-kilometer against an ordinary rate of 6 pfennigs (1.428 cents) per ton-kilometer, with terminal charges in both cases of 60 pfennigs (14.28 cents) in competition with the rates of other than German railways.[1]

There are numerous other exceptional tariffs, probably the most comprehensive being that for raw materials (exceptional tariff 2) with 10 subdivisions. It is based on a kilometric rate of 2.2 pfennigs (0.524 cent) per ton up to a distance of 350 kilometers (217.5 miles) and 1.4 pfennig (0.333 cent) per ton beyond, plus terminal charges of 0.70 mark per ton (16.66 cents).

As indicating the extent to which the exceptional rates are utilized in Germany, in the following statement is shown the freight traffic on the great Prussian railway system in metric tons during certain

[1] Report of the Board of Trade Conference (Wyman & Sons, London).

years, and the percentage of the traffic conveyed at normal and at exceptional rates.

*Freight traffic on the Prussian State railways.*

| Year. | Total tons. | Percentage conveyed at normal rates. | Percentage conveyed at exceptional rates. |
|---|---|---|---|
| 1882 | 105,036,517 | 40.9 | 59.1 |
| 1885 | 86,406,992 | 38.7 | 61.3 |
| 1890 | 118,907,870 | 53.2 | 46.8 |
| 1895 | 146,653,849 | 54.33 | 45.67 |
| 1900 | 205,682,212 | 35.73 | 64.27 |
| 1906 | 283,288,622 | 35.68 | 64.32 |

By an inspection of the above figures it will be seen that in 1906 over 64 per cent of the merchandise carried by the Prussian railways came under the exceptional rates. On the Bavarian lines during the same period the percentage of the traffic under exceptional rates was 56.7.

The exceptional tariffs are complicated and form the principal difficulty of the German freight tariff. It is estimated that there are about 1,000 books published giving the freight rates of the different railway systems. To determine the cheapest rate of transportation in many cases requires the service of an expert, especially when the merchandise may be included under one or more of the exceptional tariffs.

All of the rates given in this report, unless specially mentioned otherwise, include the terminal charges, that is the charges for placing the cars at the freight stations at the disposition of the shippers or consignees for loading or unloading the goods.

Ordinarily loading and unloading is done by or at the cost of shipper and consignee, respectively, with the exception of piece goods or small consignments, which are handled by the railway companies. If by request the railway employees undertake the loading or unloading the charges are as follows:

Loading or unloading ordinary merchandise, per 100 kilos (220.46 pounds), 4 pfennigs (0.95 cent). Loading or unloading grain, podded grains, bran, malt, and oil seeds in bulk, 6 pfennigs (1.43 cents). For use of crane, in addition to loading charges, 3 pfennigs (0.71 cent). Minimum crane charge, 0.50 marks (11.9 cents). Maximum charge per car, 2 marks (47.6 cents). For shifting crane from one station to another, 3 marks (71.4 cents).

In addition to the above there are other fees exacted by the railways of Germany, of which the following are examples:

| | Marks. |
|---|---|
| Freight bills to be filled out by the shipper, each | 0.01 (0.24c.) |
| Freight bills in quantities of 100 | .75 (17.85c.) |
| International freight bills, each | .02 (0.48c.) |
| International freight bills, in quantities of 100 | 1.50 (35.7c.) |
| Freight bills printed specially with shipper's name, 1,000 | 8.00 ($1.90) |
| International freight bills printed specially with shipper's name, 1,000 | 16.00 ($3.81) |
| Freight bills printed with shipper's name on margin, 1,000 | 8.50 ($2.02) |
| International freight bills printed with shipper's name on margin, 1,000 | 17.00 ($4.04) |

| | Marks. |
|---|---|
| Customhouse declaration and tax statements, on sheet | 0.03 (0.71c.) |
| Customhouse declaration and tax statements, one-half sheet | .01 (0.24c.) |
| Customhouse declaration and tax statements, 100 full sheets | 2.40 (57.1c.) |
| Customhouse declaration and tax statements, 100 one-half sheets | .70 (16.7c.) |
| Statistical report declarations, single | .01 (0.24c.) |
| Statistical report declarations, 100 | .80 (19.0c.) |
| Statistical report by forwarder of foreign goods, single | .02 (0.48c.) |
| Statistical report by forwarder of foreign goods, 100 | 1.80 (42.8c.) |
| For filling out Nos. 1, 2, 5, and 6 as above, each | .10 (2.4c.) |
| For filling out duplicates | .10 (2.4c.) |
| For filling out receipts for goods | .10 (2.4c.) |
| For government stamp on freight bills, per 100 | .10 (2.4c.) |
| For government stamp on international freight bills, per 100 | .20 (4.8c.) |

*Weighing fees.*

| | |
|---|---|
| For piece of package for 100 kilograms (220 pounds) | .05 (1.2c.) |
| For carload quantities, per 100 kilograms | .04 (0.95c.) |
| For weighing carloads at one time | 1.00 (23.8c.) |

*Counting fees.*

| | |
|---|---|
| For counting pieces or packages, per 20 packages | .10 (2.4c.) |
| Minimum charge on one freight bill | .20 (4.8c.) |
| Maximum charge on one freight bill | 3.00 (71.4c.) |
| For carloads up o 20 pieces | .10 (2.4c.) |
| Minimum per car | 1.00 (23.8c.) |
| Maximum per car | 3.00 (71.4c.) |

*Warehouse charges.*

| | |
|---|---|
| In covered rooms, 24 hours per 100 kilograms | .10 (2.4c.) |
| In open spaces, 24 hours per 100 kilograms | .04 (0.95c.) |
| For each square meter, 10 days or less | .02 (0.48c.) |
| For demurrage, per car ,each 24 hours after first day | 2.00 (47.6c.) |
| For demurrage, per car, each 24 hours after second day | 3.00 (71.4c.) |
| For demurrage, per car, each 24 hours after third day | 4.00 (95.2c.) |

Holidays not counted.

For countermanding order, per car, 2 marks (47.6 cents).

*Customhouse charges.*

| | |
|---|---|
| For switching cars to customhouses, per 100 kilograms | .04 (0.95c.) |
| Maximum per car | .50 (11.9c.) |
| Switching and weighing 100 kilograms or less | .10 (2.4c.) |
| Maximum per car | 6.00 ($1.43) |
| Weighing car on track scales | 1.50 (35.7c.) |
| For unloading or loading carloads | 6.00 ($1.43) |
| For unloading or loading without reweighing, per 100 kilograms | .04 (0.95c.) |
| Maximum per car | 4.50 ($1.07) |
| Opening and closing packages for inspection, each | .10 (2.4c.) |
| Opening and closing packages and repacking | .30 (7.1c.) |
| For covering dutiable goods with canvas, carload | .50 (11.9c.) |
| For covering and plumbing each package | .20 (4.8c.) |
| For roping and plumbing with lead, each package | .50 (11.9c.) |
| For hoops, iron bands, and nailing each piece | .10 (2.4c.) |
| For roping canvas covers to cars, per meter, rope | .02 (0.48c.) |
| For sealing with lead seals, per car | .75 (17.8c.) |
| For stamping each piece of iron or wood | .02 (0.48c.) |
| Minimum charge | 1.00 (23.8c.) |
| For stamping each sack | .01 (0.24c.) |

| | Marks. |
|---|---|
| For use of canvas covers, 100 kilometers (62 miles) per car, or less | 1.50 (35.7c.) |
| For use of canvas covers, each additional cover | .50 (11.9c.) |
| Minimum charge per 100 kilometers (62 miles) | 2.00 (47.6c.) |
| Extra charge for use of covers after delivery, each 24 hours | .50 (11.9c.) |
| Disinfections, per car | 1.00 (23.8c.) |

The regulations governing the traffic on the German railways are given in "Deutscher Eisenbahn Gütertariff, Teil I, Abteilung A," with its supplement. The "Deutscher Eisenbahn Gütertariff, Teil I, Abteilung B," contains the classification of merchandise, supplementary charges, etc.

## Question I.—Coal Rates.

Each state system of railways in Germany, such as the Prussian, Bavarian, Saxon, Würtemburg, Baden, etc., has its own schedule of freight rates, but, as stated before, they differ slightly from each other. The rates given in the following schedules are those which, with a few modifications, prevail in the interstate traffic.

In the general carload freight classification, coal is placed under Special Tariff III, the rates for which, as shown in the table of normal rates, page 12, are 2.6 pfennigs (0.619 cent) per ton-kilometer for distances from 1 to 100 kilometers (0.62 to 62.1 miles), and 2.2 pfennigs (0.524 cent) for distances over 100 kilometers, with terminal charges per ton as follows: Sixty pfennigs (14.28 cents) for distances up to and including 50 kilometers (31.05 miles), 90 pfennigs (21.42 cents) per ton, from 51 kilometers (31.7 miles) to 100 kilometers, and 120 pfennigs (28.56 cents) for all distances over 100 kilometers.

The great bulk of the German coal traffic, however, is transported at exceptional rates; the principle ones are as follows:

In the direct traffic on all the German railways, from the German coal-mining centers, except when other exceptional rates apply, coal may be shipped to all parts of the Empire under the exceptional tariff for raw materials (exceptional tariff 2). In carload lots of not less than 10 metric tons, the rates are as follows: Up to 350 kilometers (217.5 miles), 2.2 pfennigs (0.524 cent) per ton-kilometer; over 350 kilometers, 1.4 pfennigs (0.333 cent) per ton-kilometer, with terminal charges of 70 pfennigs (16.66 cents) per ton.

As an example, the rate from Herne, in the Westphalian coal district, to Munich, a distance of 688 kilometers (427.5 miles), is calculated as follows:

| | Pfennigs. |
|---|---|
| 350 by 2.2 | 770 |
| 338 by 1.4 | 473.2 |
| Terminal charge | 70 |
| | 1,313.2 |

Discarding the pfennigs less than 5, the rate is 1,310 pfennigs ($3.12), as given in the "Allgemeine Kilometer-Tarifftabelle."

As illustrating the above exceptional rate, in the following table are shown the rates on coal in not less than 10-ton shipments from the

principal German mining districts to 10 of the German cities, together with the distances in kilometers and miles:

*Coal freight rates per metric ton (2,204.6 pounds), in carload lots of not less than 10 tons, from various mines, with distances from the mines to the points named.*

| To— | From Herne, Westphalia. | | | | From Zwickau, Saxony. | | | | From Zabrorze, Silesia. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Distance. | | Rate. | | Distance. | | Rate. | | Distance. | | Rate. | |
| | Kilometers. | Miles. | Marks. | Dollars. | Kilometers. | Miles. | Marks. | Dollars. | Kilometers. | Miles. | Marks. | Dollars. |
| Nuremberg | 514 | 319.38 | 10.70 | 2.55 | 263 | 163.42 | 6.50 | 1.55 | 752 | 467.27 | 14.00 | 3.33 |
| Würzburg | 412 | 256.0 | 9.30 | 2.21 | 319 | 198.22 | 7.70 | 1.83 | 832 | 516.98 | 15.10 | 3.59 |
| Munich | 688 | 427.5 | 13.10 | 3.12 | 407 | 252.9 | 9.20 | 2.19 | 833 | 517.6 | 15.20 | 3.62 |
| Augsburg | 627 | 389.6 | 12.30 | 2.93 | 410 | 254.76 | 9.20 | 2.19 | 843 | 523.81 | 15.30 | 3.64 |
| Lindau | 694 | 431.23 | 13.20 | 3.14 | 567 | 352.32 | 11.40 | 2.71 | 1,007 | 625.72 | 17.60 | 4.19 |
| Passau | 732 | 454.84 | 13.70 | 3.26 | 387 | 240.47 | 8.90 | 2.12 | 701 | 435.58 | 13.30 | 3.17 |
| Regensburg | 615 | 382.14 | 12.10 | 2.88 | 270 | 167.77 | 6.60 | 1.57 | 702 | 436.2 | 13.30 | 3.17 |
| Baireuth | 535 | 332.43 | 11.00 | 2.62 | 171 | 106.25 | 4.50 | 1.07 | 695 | 431.85 | 13.20 | 3.14 |
| Hof | 561 | 348.59 | 11.40 | 2.71 | 97 | 60.27 | 2.80 | .67 | 661 | 410.73 | 12.80 | 3.05 |
| Bamberg | 482 | 299.5 | 10.20 | 2.43 | 219 | 136.08 | 5.50 | 1.31 | 774 | 480.94 | 14.30 | 3.40 |

The longest distance which coal is hauled in Germany is probably from Herne, in Westphalia, to Bajohren, in the northeastern part of the Empire near Memel, 1,321 kilometers (821 miles). The freight per ton is 22 marks ($5.24).

The exceptional rate on Lower Silesian coal to Berlin and suburbs is 1.96 pfennigs (0.466 cent) per ton-kilometer plus a terminal charge of 70 pfennigs (16.66 cents) per ton.

The rate was established to place the Lower Silesian coal on a level with coal from Upper Silesia in the markets of Berlin and suburbs and is based on the average rate on shipments of coal from Upper Silesia.

### SILESIAN COAL.

From the Upper Silesian coal mines to Danzig and its suburbs, and to Stettin and Swinemünde, there is an exceptional tariff for coal, when shipped in lots of at least 45 tons, and intended for bunker purposes of seagoing steamers, not those engaged in the local traffic between the ports of East and West Prussia and Pomerania.

The rate is 1.34 pfennigs (0.319 cent) per ton-kilometer plus a terminal charge of 60 pfennigs (14.28 cents) per ton. For cars whose loading weight is more than 10 tons but less than 15 tons the freight is calculated on a weight of 10 tons.

This tariff was made to enable Silesian coal to compete with foreign coal and to place it on a more equitable basis with Westphalian coal, as the latter may be transported cheaper by water via Rotterdam to Stettin and Swinemünde than the Silesian coal.

From the Upper and Lower Silesian coal mines to East and West Prussia and Hinter Pomerania, in shipments of 35 and 45 tons, or yearly shipments of 4,000 tons, the exceptional rate is 1.46 pfennigs (0.347 cent) per ton-kilometer plus 60 pfennigs (14.28 cents) per ton terminal charges.

To Vor-Pomerania, Uckermark, and Mecklenburg the rate for Silesian coal is not to exceed 1.52 pfennigs (0.362 cent) per ton-kilometer with terminal charges of from 30 to 60 pfennigs (from 7.14 to 14.28 cents) per ton.

To East and West Prussia, north of the line Putzig-Danzig-Marienburg-Königsberg-Insterburg-Goldap, the rate is up to 535 kilometers (332.4 miles), 1.46 pfennigs (0.347 cent) per ton-kilometer; from 536 kilometers (333 miles) to 700 kilometers (436 miles), 1.44 pfennig (0.343 cent) per ton-kilometer, and over 700 kilometers 1.42 pfennigs (0.338 cent) per ton-kilometer, the terminal charges in each case being 60 pfennigs (14.28 cents) per ton.

These rates were established to develop the sale of native coal in the localities mentioned in competition with coal from foreign countries, principally from Great Britain.

The exceptional rate of coal from Lower Silesia to Dresden and points beyond is 2.1 pfennigs (0.5 cent) per ton-kilometer, with terminal charges of 30 pfennigs (7.14 cents) per ton.

The concession granted for Silesian coal sent to Dresden and beyond was for the purpose of enabling it to successfully compete with Bohemian brown coal and as a compensation for the reduced exports of the German coal to Russia.

To increase the export of Silesian coal to Denmark (Seeland, Laaland, Falster) via Warnemunde, the rate for shipments of at least 45 tons is 1.34 pfennigs (0.319 cent) per ton-kilometer plus a terminal charge of 45 pfennigs (10.71 cents) per ton, inclusive of the charge of hauling the coal from the mines to the shipping station.

### WESTPHALIAN COAL.

To facilitate the distribution of German coal through the Rhine ports of Duisburg, Hochfeld, and Ruhrort, a special rate is made on shipments from the Ruhr district to those localities. The basis of the rate is 2.5 pfennigs (0.595 cent) per ton-kilometer, plus a terminal charge of 90 pfennigs (21.42 cents) per ton, inclusive of the hauling charges from the mines to the shipping stations and the port charges. The above is the rate basis for 10 tons; for 12.5 tons, 15, and 20 tons the rate is lower—for instance, the freight charges from Herne on 10 tons to Ruhrort, a distance of 34 kilometers (21.13 miles), is 17.50 marks ($4.17), while the rate for 12.5 tons is 21 marks ($5), for 15 tons 24.50 marks ($5.85), and for 20 tons 31.50 marks ($7.50).

From the Ruhr district there is also an exceptional rate on coal shipped in lots of at least 45 tons, or 4,000 tons in one year, to the furnaces rolling mills, etc., of the Sieger, Lahn, and Dill districts.

The basis of the rate is 1.4 pfennigs (0.333 cent) per ton-kilometer plus 60 pfennigs (14.28 cents) terminal charges.

To the Georg-Marien furnaces and Osnabrück the rate is 1.5 pfennigs (0.357 cent) per ton-kilometer and to Vienenburg 1.6 pfennigs (0.38 cent), plus the same terminal charges as above.

The rates were established to promote the iron-ore and steel industries of the districts mentioned.

The rates on coal from the Ruhr district to Schleswig-Holstein, Lübeck, Mecklenburg, Prignitz, and adjoining stations is according to the group tariffs of the dispatching stations. The rate is variable,

depending upon the competition of English coal. At present it is about the same as the rate when the coal is shipped for export to the Elbe, Weser, and Ems ports in large shipments, as given below.

The rate was made because the previous cost of transportation to the districts was so high that foreign coal had to be used, even by the military authorities of the Ninth Army Corps.

The rate for the Ruhr coal, when exported to Denmark in lots of at least 45 tons, via Warnemunde is the same as for Silesian coal, namely, 1.34 pfennigs (0.319 cent) per ton-kilometer plus a terminal charge of 45 pfennigs (10.71 cents) per ton, inclusive of the charge of hauling the coal from the mines to the shipping stations. When sent via Bamdrup and Hvidding the rate is 1.32 pfennigs (0.314 cent) plus the same terminal and hauling charges.

When sent to the Elbe, Weser, and Ems ports, in lots of at least 45 tons or for shipments of at least 4,000 tons in one year, Ruhr coal pays rates according to the group tariffs. The rates for export, for example, from Wanne to Hamburg are 1.40 pfennigs (0.333 cent) per ton-kilometer; to Bremen, 1.65 pfennigs (0.393 cent); to Bremerhaven and Geestemünde, 1.31 pfennigs (0.312 cent); and to Emden, 1.28 pfennigs (0.307 cent), plus terminal charges in each case of 60 pfennigs (14.28 cents) per ton and hauling charges from the mines to the shipping stations of 15 pfennigs (3.57 cents) per ton.

These rates were established to increase the use of native coal in the North Sea ports and the adjacent country and to meet the competition of English coal in the export trade.

To Emden, Emden Outer Port, Leer, and Papenburg, in shipments of from 200 to 300 tons for export to European ports in the Mediterranean and Black Sea, the rate on Westphalian coal is on the average 1.23 pfennigs (0.293 cent) per ton-kilometer plus terminal charges of 60 pfennigs (14.28 cents) and mine charges of 15 pfennigs (3.57 cents) per ton.

The rate was made to develop the export of German coal through the Ems ports instead of through foreign ports.

For export of Westphalian coal to Holland the rate, when shipped in lots of 45 tons, or in a yearly quantity of 4,000 tons, to the ports and important adjacent stations, is from 2.19 to 1.79 pfennigs (0.521 to 0.426 cent) per ton-kilometer, and if sent in special trains carrying from 200 to 300 tons the rate is from 1.87 to 1.52 pfennigs (0.445 to 0.362 cent) per ton-kilometer plus a terminal charge in each case of 35 pfennigs (8.33 cents) per ton.

The rate was established to increase the consumption of German coal in Holland.

For export to Belgium the rate is 1.7 pfennigs (0.405 cent) per ton-kilometer when shipped in lots of at least 45 tons, or a yearly amount of 4,000 tons, and when shipped in special trains carrying from 200 to 300 tons the rate is from 1.73 to 1.47 pfennigs (0.412 to 0.35 cent) per ton-kilometer, plus a terminal charge in each case of 40 pfennigs (9.52 cents) per ton. The rate when shipped to the above ports and stations, if for local consumption and not for export, is 1.9 pfennigs (0.452 cent) per ton-kilometer.

The rate on Westphalian coking coal when shipped to the Franco-German frontier station of Fentsch, Novèant, and Amanweiler is as follows: To Fentsch, 2 pfennigs (0.476 cent) per ton-kilometer plus

terminal charge of 60 pfennigs (14.28 cents) per ton; to Amanweiler, about 1.87 pfennigs (0.445 cent) per ton-kilometer, and terminal charges of 35 pfennigs (8.33 cents) per ton; and to Novèant, about 1.77 pfennigs (0.421 cent) per ton-kilometer, with the same terminal charges as to Amanweiler.

The rate was made to increase the consumption of German coking coal in the iron and steel districts of eastern France.

The rate on coking coal and coke for the use of the furnaces in Alsace-Lorraine, Luxemburg and Saar districts from the Ruhr, Aix-la-Chapelle and Saar districts is as follows:

From 80 to 350 kilometers (49.7 to 217.5 miles), 2.2 pfennigs (0.524 cent) per ton-kilometer, with terminal charges as follows:

From 80 to 200 kilometers (49.7 to 124.3 miles), 50 pfennigs (11.9 cents) per ton.

From 201 to 290 kilometers (124.9 to 180.2 miles), 40 pfennigs (9.52 cents) per ton.

From 291 to 350 kilometers (180.8 to 217.5 miles), 20 pfennigs (4.76 cents) per ton.

The rate increment over 350 kilometers is 1.4 pfennigs (0.333 cent) per ton-kilometer. The rate was established to enable the German coal to compete with foreign coal and coke in the Minette and Saar districts.

The rate on coal from Gustavsburg, in the Hessian Province of Starkenburg to Aschaffenburg and stations of the Bavarian State Railway, made to increase the traffic on the Prussian railway system, is 2.2 pfennigs (0.524 cent) per ton-kilometer plus terminal charges of 70 pfennigs (16.66 cents), 40 pfennigs (9.52 cents), and 36 pfennigs (8.57 cents), respectively.

The rate for Belgian coal to Rheinland-Westphalia is 2.1 pfennigs (0.5 cent) per ton-kilometer plus a terminal charge of 40 pfennigs (9.52 cents) per ton. This rate was given to Belgian coal imported into Germany on account of the concessions granted by the Belgian Government on German coal imported into Belgium.

The rate on coal shipped from stations on the lines of the Holland State Railway to the stations on the left bank of the Rhine (southwestern district of the Prussian Railway system, including private connecting lines) is 2.2 pfennigs (0.524 cent) per ton-kilometer plus a terminal charge of 35 pfennigs (8.33 cents) per ton.

### LIGNITE (BRAUNKOHL).

The freight rates for lignite are the same as those for coal when shipped from the German lignite mining centers to all parts of the Empire in direct traffic, except when other exceptional rates apply. As stated before, in carload lots of not less than 10 metric tons the rates are as follows: Up to 350 kilometers (217.5 miles), 2.2 pfennigs (0.524 cent) per ton-kilometer; over 350 kilometers, 1.4 pfennigs (0.333 cent) per ton-kilometer, with terminal charges of 70 pfennigs (16.66 cents) per ton.

The rate on lignite from mines in the Provinces of Brandenburg, Posen, Saxony, and Silesia, as well as in Brunswick, Anhalt, and in the Kingdom of Saxony to Berlin and suburbs, is 2.2 pfennigs (0.524 cent) per ton-kilometer, with a terminal charge of 30 pfennigs (7.14 cents) per ton.

The rate was made to meet the competition of foreign lignite in the localities mentioned.

For the most part the exceptional tariffs for coal shipped from the Ruhr district apply also to lignite.

From the shipping stations of the mines in the Rhine district the freight rate on lignite sent to Holland in lots of at least 45 tons, or for shipments amounting in one year to at least 4,000 tons, is up to 1.6 pfennigs (0.381 cent) per ton-kilometer, with a terminal charge of 30 pfennigs (7.14 cents) per ton.

The rate for lignite shipped from middle Germany to Denmark is as follows: Via Warnemunde, 1.34 pfennigs (0.319 cent) per ton-kilo; via Bamdrup and Hvidding, 1.32 pfennigs (0.314 cent) per ton-kilo, with terminal charge in each case of 45 pfennigs (10.71 cents) per ton.

The above rates were established to increase the export trade in German lignite.

#### REBATES.

When coal is shipped under the exceptional rate, which requires that a stated amount shall be sent in one year, the fact is noted on the bill of lading, and the exceptional rate for smaller shipments is paid at the time when the coal is shipped. At the end of the year the difference between the higher rate and that for a prescribed yearly quantity is refunded to the shipper, if the conditions have been fulfilled, within three months after filing the claim for the rebate.

As stated before, the terminal charges are for placing the cars at the freight stations at the disposition of the shippers or consignees for loading or unloading the coal. If the loading or unloading is done by the railway company an extra charge is made, according to the tariff of subsidiary charges given on page 17.

Coal is usually shipped in open cars built for the coal trade. They are of a capacity of 10, 25, 15, and 20 tons, and for the coke trade as high as 40 tons.

## Question II.—Iron Ore, Stone, Lumber.

### *1. Iron ore.*

In the general classification of freight in carloads iron ore, the same as coal, is placed under Special Tariff III, the rates for which, as shown in the table of normal rates, page 12, are 2.6 pfennigs (0.619 cent) per ton-kilometer for distances from 1 to 100 kilometers (0.62 to 62.1 miles), and 2.2 pfennigs (0.524 cent) for distances over 100 kilometers, with terminal charges per ton as follows: Sixty pfennigs (14.28 cents) for distances up to and including 50 kilometers (31.05 miles), 90 pfennigs (21.42 cents) from 51 to 100 kilometers (31.7 to 62.1 miles), and 120 pfennigs (28.56 cents) for all distances over 100 kilometers.

The greater part of the German iron-ore traffic, however, is transported at exceptional rates, the principal ones being as follows:

In the direct traffic on German railways and on foreign railways which grant the same rates, except when other exceptional rates ap-

ply, iron ore may be shipped to all parts of the Empire under the exceptional tariff for raw materials (exceptional tariff 2). In carload lots of not less than 10 metric tons the rates are as follows: Up to 350 kilometers (217.5 miles), 2.2 pfennigs (0.524 cent) per ton-kilometer; over 350 kilometers, 1.4 pfennigs (0.333 cent) per ton-kilometer, with terminal charges of 70 pfennigs (16.66 cents) per ton. The rate for distances over 350 kilometers—450 kilometers, for instance—is calculated up to 350 kilometers at 2.2 pfennigs per ton, and for the distance over 350 kilometers, namely, 100 kilometers, at 1.4 pfennigs per ton.

In the local and exchange traffic of the Western State and Private Railways, the railways of southern Germany, Province of Saxony, Luxemburg, Belgium, France (Northern Railway), and Austria-Hungary, as well as from the ore mines of the middle and eastern Provinces to Silesian, Thuringian, and Harz furnaces, from Saxon stations to the Upper Silesian furnace districts, and between Saxon and Thuringian stations and from Breslau municipal harbors and Popelwitz (transfer station) to Upper Silesia, the rate on iron ore is as follows: Up to 50 kilometers (31.07 miles), 2 pfennigs (0.476 cent) per ton-kilometer; over 50 kilometers, 1.8 pfennigs (0.428 cent) per ton-kilometer, with terminal charges of from 80 to 120 pfennigs (19.04 to 28.56 cents), the minimum rate being 2.2 pfennigs (0.524 cent) per ton-kilometer without terminal charge.

From Vienna and Hungarian stations to upper Silesia and from Altwasser, Gottesberg, and Neurode to Mährisch-Ostrau and Trzymetz the rate is 2.2 pfennigs (0.524 cent) per ton-kilometer without terminal charge, and from Mährisch-Ostrau, Hruschau, and Schönbrunn to Upper Silesia the rate is 1.8 pfennigs (0.428 cent) per ton-kilometer, plus a terminal charge of 60 pfennigs (14.28 cents) per ton.

To the furnace stations and lead-smelting works, from Belgium and the Franco-German frontier transit stations, the rate is as follows:

Up to 100 kilometers (62.14 miles) 1.8 pfennigs (0.428 cent) per ton-kilometer.

From 101 to 190 kilometers (62.76 to 118.06 miles) 1.5 pfennigs (0.357 cent) per ton-kilometer.

Over 190 kilometers (118.06 miles) 1 pfennig (0.238 cent) per ton-kilometer, plus a terminal charge of 70 pfennigs (16.66 cents) per ton.

These rates were established to increase the sources of ore supply, especially the Minette ores from Alsace-Lorraine and Luxemburg, in place of other foreign ores and in the interest of the western furnace districts by supplying them with French ores.

The exceptional rate on iron ore for furnace use from the German seaports, and from Danish, Swedish, and Norwegian stations to Bohemian stations is as follows: Up to 100 kilometers (62.14 miles) 2.2 pfennigs (0.524 cent) per ton-kilometer; above 100 kilometers (62.14 miles) 1.5 pfennigs (0.357 cent) per ton-kilometer, plus a terminal charge of 70 pfennigs (16.66 cents) per ton.

The above rate also applies to shipments of iron ore from Hungary and Steiermark to Upper Silesia.

From the shipping stations of the Lahn, Dill, and Sieg districts to the furnace stations of the Ruhr, Saar, Aix-la-Chapelle, Luxem-

burg, and Alsace-Lorraine districts, the rate on iron ore is 1.25 pfennigs (0.298 cent) per ton-kilometer, plus a terminal charge of 60 pfennigs (14.28 cents) per ton for all distances.

The rate was established to foster the ore-mining industries on the rivers Lahn, the Dill, and the Sieg, and to counterbalance the unfavorable conditions under which the above mines operate in competition with the districts which have a reduced iron-ore and coke tariff.

For the iron ore traffic between the stations of the industrial districts of Lahn, Dill, Siegerland, and Brilon, the rate is 1.5 pfennigs (0.357 cent) per ton-kilometer, plus a terminal charge of 60 pfennigs (14.28 cents) per ton-kilometer for all distances.

The rate on iron ore from Kirchlengern (Hanover district) to the Georgs-Marien furnace near Osnabrück is 1.6 pfennigs (0.381 cent) per ton-kilometer, plus a terminal charge of 70 pfennigs (16.66 cents) per ton.

The rate was established to make it possible for the Porta ore to compete in Osnabrück with foreign ores.

There are exceptional rates on iron ore shipped in lots of at least 45 tons from Stettin, Swinemünde, Danzig, and Neufahrwasser to the Silesian furnace districts; from the German North Sea ports and Kiel to the Rhine-Westphalian furnace district, and from the Elbe and Weser ports and Lübeck to Vienenburg.

The rate from Stettin, Swinemünde, Danzig, and Neufahrwasser is 1.34 pfennigs (0.319 cent) per ton-kilometer, plus a terminal charge of 60 pfennigs (14.28 cents) per ton.

This rate is also applicable to foreign iron ore shipped from Stettin to Mährisch-Ostrau.

The rate to Vienenburg is 1.5 pfennigs (0.357 cents) per ton-kilometer, plus terminal charges of 70 pfennigs (16.66 cents) per ton, which is about the average rate for iron ore shipped from North Sea and Baltic ports to Rhine-Westphalian and Upper Silesian districts.

The rate on iron-ore traffic between Bavaria and Frankfort on the Main, Kassel, Gustavsburg, Mayence, and Mannheim is 2.2 pfennigs (0.524 cent) per ton-kilometer without terminal charges.

This rate was made to compete with ore shipped via the transfer station of the Baden railway at Mannheim.

The rate on iron ore between the Prussian-Saxon competing stations and Bavarian stations is from 1.83 pfennigs (0.436 cent) per ton-kilometer, plus a terminal charge of 60 pfennigs (14.28 cents) per ton, to 1.5 pfennigs (0.357 cent) per ton-kilometer, plus a terminal charge of 30 pfennigs (7.14 cents) per ton.

From German and Dutch stations to Russia, excepting Poland in the Dutch-German-Russian Association and Frontier Traffic, the rate on iron ore per ton-kilometer over the German railways is 1.75 pfennigs (0.417 cent).

In the direct traffic there is no terminal charge, as the railways receive a portion of the terminal charges collected by the Russian railways. In the frontier traffic the terminal charge is 30 pfennigs (7.14 cents) per ton.

Ores of various kinds used for the construction of German public or private roads and the maintenance of same are carried at excep-

tional rates over the Prussian railways and over other railways which have accepted the same rate basis.

The rate is as follows:

Up to 50 kilometers (31.07 miles), 2.6 pfennigs (0.619 cent) per ton-kilometer; from 51 to 200 kilometers (31.69 to 124.3 miles), 1.0 pfennig (0.238 cent) per ton-kilometer; over 200 kilometers, 1.4 pfennigs (0.333 cent) per ton-kilometer for the whole distance carried, plus terminal charges of 60 pfennigs (14.28 cents).

As an example of the calculation of the rate, if the distance were 200 kilometers (124.3 miles) the rate would be per ton:

| | Pfennigs. |
|---|---|
| 50 by 2.6 | 130 |
| 150 by 1.0 | 150 |
| 1 by 60 | 60 |
| | 340 (80.9 cents). |

For a distance of 220 kilometers (136.7 miles) the rate would be:

| | Pfennigs. |
|---|---|
| 220 by 1.4 | 308 |
| 1 by 60 | 60 |
| | 368 (87.6 cents). |

### *2. Stone.*

In the general carload freight classification, stone is placed under Special Tariffs II and III, as follows:

#### Special Tariff II.

STONE UNPACKED OR LOOSE IN HAY, STRAW, ETC., OR CRATED OR IN OPEN BOXES, AND IN CASE OF STONE FOR EXPORT IN SUITABLE PACKING.

1. Cut stone not named in Special Tariff III or otherwise specially mentioned.
2. Mill stones formed of several pieces, not mentioned in Special Tariff III, molded mill stones.
3. Artificial stone not named in Special Tariff III, or otherwise specially mentioned, corundum or emery wheels, etc.

#### Special Tariff III.

Packing same as Special Tariff II.

1. Stone otherwise not mentioned, rough, or roughly hewn, only split not sawed, with the exception of marble slabs and so-called Belgian granite, sawed up to a thickness of 16 centimeters (6.3 inches) stone chips, broken stone, etc.
2. Building stone, cut to dimensions, stone for steps.
3. Foundation stone for graves and monuments and for grave and monument inclosures.
4. Pavement stone, curbstones, border and milestones, slabs, excepting those of marble and so-called Belgian granite, up to 16 centimeters (6.3 inches) thick.
5. Hollowed stone; stone for crib work, troughs for well and spring curbing, gutter stone and stone for culverts, etc.

Stone under paragraphs from 2 to 5, also polished and ground.

6. Mill stones in one piece, mill stones made of sandstone, also made of several pieces, rollers, and grindstones.

(Pumice stone, whetstones, emery, corundum wheels, etc.)

7. Artificial stone, otherwise not mentioned; stone in the form and condition named in paragraphs 2 to 5, building and roofing stone, facing stone, floor stones, and filter slabs.

8. Stone otherwise not mentioned, natural and artificial; ground, crushed, in cubes for making pavements, etc., suitably packed.

The rate for stone included under Special Tariff II, as shown in table of normal rates, page 12, is as follows for carload shipments of at least 10 tons: 3.5 pfennigs (0.833 cent) per ton-kilometer for all distances from 1 to 50 kilometers (0.62 to 31.07 miles) plus a terminal charge of 60 pfennigs (14.28 cents) per ton; 90 pfennigs (21.42 cents) per ton from 51 to 100 kilometers (31.7 to 62.14 miles); and 120 pfennigs (28.56 cents) per ton for all distances over 100 kilometers.

The rate for Special Tariff III is 2.6 pfennigs (0.619 cent) per ton-kilometer up to and including 100 kilometers (0.62 to 62.14 miles), and 2.2 pfennigs (0.524 cent) per ton-kilometer for all distances over 100 kilometers, with the same terminal charges as for Special Tariff II.

The above and the following rates for stone are for shipments of not less than 10 tons, unless otherwise mentioned. There are exceptional rates for stone in force in different parts of Germany, the most important of which are as follows:

Stone for public and private road-making purposes, sidewalks, bridges, and quays, and their maintenance, in Germany and in the Duchy of Luxembourg; quarry and field stones, bowlders, roughly cut border and milestones, etc., are transported to all parts of Germany and to the Duchy of Luxembourg at an exceptional rate.

The basis of the rate is as follows:

Up to 50 kilometers (31.07 miles), 2.6 pfennigs (0.619 cent) per ton-kilometer; from 51 to 200 kilometers (31.7 to 124.3 miles), 1 pfennig (0.238 cent) per ton-kilometer; and for distances over 200 kilometers the rate is calculated at 1.4 pfennig (0.333 cent) for the total distance. The terminal charge in each case is 60 pfennigs (14.28 cents) per ton.

Stone mentioned in Special Tariff III has an exceptional rate in the district of the former Hessian-Ludwigs Railway; also in the traffic with Nassau, Upper Hessian, and Westerwald stations, and in the direct traffic with southern German stations and beyond.

The basis of the rate is 2 pfennigs (0.476 cent) per ton-kilometer, and terminal charges of 60 pfennigs (14.28 cents) and 30 pfennigs (7.14 cents) per ton, respectively. In the direct traffic with the southern German stations the terminal charge is 30 pfennigs (7.14 cents) per ton.

From the Silesian stations to Sosnowice, Herby, Kattowitz, Russian frontier stations, stone of Special Tariff III is transported at the following rate:

Up to 100 kilometers (62.14 miles), 2.6 pfennigs (0.619 cent) per ton-kilometer; above 100 kilometers, at the rate of 2.2 pfennigs (0.524 cent) per ton-kilometer, with a terminal charge of 30 pfennigs (7.14 cents) in each case.

The rate was made to develop the export trade in German stone with Russia.

The rate on quarry, building, and paving stone from Piesburg and stations on the line from Osnabrück-Rhein-Gildhais to the Ems ports is 2.2 pfennigs (0.524 cent) per ton-kilometer, with a terminal charge of 60 pfennigs (14.28 cents) per ton when shipped in lots of not less than 30 tons from one shipper to one consignee. On rough stone from Piesburg to Bremen the rate is same as above, with a terminal charge of 70 pfennigs (16.66 cents) per ton.

On rough quarry stone, not worked, of dimensions not greater than one-half meter (1.62 feet) wide, long, or high the rate from Piesburg and near-by stations to Bremen, Bremerhaven, Geestemünde, Brake, Nordenham, and Wilhelmshaven is from 1.8 to 1.62 pfennigs (0.428 to 0.386 cent) per ton-kilometer, with terminal charges of 60 pfennigs (14.28 cents) per ton.

The rate on rough basalt stone from Dehrn, Heckholzhaufen, and Steeden to Oberlahnstein, for export to Holland, is based on the rate of Special Tariff III, given on page 28.

The rate on paving stone, crushed stone, etc., for road construction from the stations on the Prussian and Saxon state railways and from the middle German private railway stations to Berlin and suburbs is from 2.6 to 2.2 pfennigs (0.619 to 0.524 cent) per ton-kilometer, with a terminal charge of 60 pfennigs (14.28 cents) per ton for distances up to 250 kilometers (155.3 miles); over that distance the terminal charge is 30 pfennigs (7.14 cents) per ton.

The rate on refuse from quarries, ashes of all kinds, sand, gravel, etc., from all stations on the state railways to the coal districts of Ruhr, Saar, Upper and Lower Silesia, Aix la Chapelle, Eschweiler, is 1.5 pfennigs (0.357 cent) per ton-kilometer up to 20 kilometers (12.4 miles), and for each additional ton-kilometer (0.62 mile) 1.1 pfennigs (0.262 cent), with terminal charges of 30 pfennigs (7.14 cents) per ton.

This rate is an experimental one, to promote the economical operation of the coal mines in the districts named.

In the traffic between Holland, Germany, and Russia, not including Poland, there are three exceptional tariffs, namely, 1A, 2A, 2B, which cover a number of products. Under exceptional tariff 2A, are included lithograph stone, whetstones, fine and artificial, basamite, emery and corundum wheels, millstones, all other stone rough or only roughly hewn, with the exception of stone bricks, flat-stone tiles, stone-roofing tiles, basalt, etc., and stone mentioned in exceptional tariff 2B, marble bathtubs, monuments of marble or other stone, all other cut stone, with the exception of flagstones, slabs, step stone, base stone, stone door and window facings, stone posts and pillars, made of marble, sandstone, etc.

Under exceptional tariff 2B are included beton stone, flint stone, stone for filters, slabs for filters, millstones made of one piece, or when made of sandstone of several pieces, rough whetstones, grindstones, Kiln stones, Dinas stone, pyrogranite, etc.

The rates are as follows over the German railway for the through traffic to Russia in not less than 10-ton lots: Exceptional tariff 2A, 2 pfennigs (0.476 cent) per ton-kilometer; exceptional tariff 2B, 1.75 pfennigs (0.417 cent) per ton-kilometer, without extra terminal charge.

For traffic to the Russian frontiers only the above rates apply except that there is a terminal charge of 30 pfennigs (7.14 cents) per ton in addition.

The exceptional rate on facing and roofing stone from Siegersdorf in Silesia, Raucha, Freiwalden, Langenberg and Nieder-Ullersdorf, to East Switzerland and Lindau (transit) is 1.48 pfennigs (0.352 cent) per ton-kilometer, with a terminal charge of 60 pfennigs (14.28 cents) per ton.

From Siegersdorf, in Silesia, and Ullersdorf to Holland, and from Heidegersdorf, Laban, Siegersdorf, and Ullersdorf to Belgian stations, the rate on facing stone is from 1.775 to 1.69 pfennigs (0.422 to 0.402 cent) per ton-kilometer, with a terminal charge of 60 pfennigs (14.28 cents) per ton.

The exceptional rate on lithographic stone from Pappenheim, Treuchtlingen, and Solnhofen in Bavaria, to German, Belgian, and Dutch seaports, and to Sweden and Norway, is from 3.483 to 3.29 pfennigs (0.829 to 0.783 cent) per ton-kilometer, plus terminal charges of from 60 to 1.20 pfennigs (14.28 to 28.56 cents) per ton.

The exceptional rate for roofing slates from stations near the slate quarries shipped to all parts of Germany, and for export to Austria-Hungary, for distances up to 200 kilometers (124.3 miles) is 2.6 pfennigs (0.619 cent) per ton-kilometer, and above 200 kilometers, 1.4 pfennigs (0.333 cent) with terminal charges per ton as follows: 60 pfennigs (14.28 cents) for distances up to and including 50 kilometers (31.05 miles); 90 pfennigs (21.42 cents) from 51 to 100 kilometers (31.7 to 62.1 miles) and 120 pfennigs (28.56 cents) for all distances over 100 kilometers.

The rate was made to meet the competition of foreign slates coming by water.

### *3. Lumber.*

In the general classification of freight in carload lots, wood is placed under Special Tariffs I, II, and III, as follows:

*Special Tariff I.*—Beams, boards, blocks, and planks (the latter also planed, grooved, tongued, perforated, fluted, or otherwise worked), as well as slabs from species which are not worked or have their origin in the forests of middle Europe, as, for example, boxwood, cedar, lemon or candle wood, cypress, ebony, red ebony (Grenadillo), hickory, laurel, mahogany, olive, citron, lignum-vitæ, pitch pine, yellow pine, satinwood, teak, and American black walnut.

By species is meant the botanical species.

*Special Tariff II.*—Wood (excepting the species mentioned in Special Tariff I, which is not worked nor has its origin in the forests of middle Europe).

1. Logs, split or hewn, billets, and faggots, in as far as they are not mentioned in Special Tariff III.

2. Willow wood, 1 year old, staves, and wood for same, in as far as it does not come under Special Tariff III, No. 7.

3. Sawed timber, also planed, tongued, and grooved, or otherwise worked. (*a*) Squared, in the form of beams, rafters, laths, cornices. (*b*) Wide, in the form of boards, planks, and floor planks. (*c*) Thin boards for parquette flooring.

4. Brush brooms.

5. Impregnated wood for telegraph poles, etc., not mentioned in Special Tariff III.

6. Shavings. (See also Special Tariff III.)

*Special Tariff III.*—Wood (excepting the species mentioned in special Tariff I, which is not worked nor has its origin in the forests of middle Europe).

1. Logs and poles, roughly hewn or split, wood for poles less than 10 centimeters (3.94 inches) in diameter, cut lengthwise one or more times, with bark on one side, and if impregnated at one end, billets less than 2.5 meters (8.5 feet) in length.

2. Roots and refuse wood.

3. Withes, hoopwood, and broom material not mentioned in Special Tariff II.

4. Railway ties, rough or impregnated.

5. Slabs, not more than 6 meters (19.7 feet) long, and not over 5 centimeters (1.97 inches) thick measured at the thin end, not including the bark.

6. Timber for mine supports, up to a thickness of 20 centimeters (7.87 inches), measured at the smallest end, not including the bark, and up to a length of 7 meters (23 feet), planks, etc., and up to a length of 6 meters (19.7 feet), and boards up to a length of 1.5 meters (4.92 feet).

7. Pickets from soft wood up to a length of 1.25 meters (4.1 feet) and 25 millimeters (0.98 inch) in thickness, unplaned, loose, or corded or wired, in bags or boxes, of which the wood is at least 12 millimeters (0.47 inch) thick, also the same planed for the export trade.

8. Dowels and pegs, in the rough; sawdust.

As shown in the table of normal rates, given on page 12 of this report, the basis of the rate of the above special tariffs are as follows:

*Special Tariff I.*—4.5 pfennigs (1.071 cents) per ton-kilometer for all distances, with terminal charges of 60 pfennigs (14.28 cents) per ton, for distances up to and including 50 kilometers (31.07 miles); 90 pfennigs (21.42 cents) for all distances between 51 and 100 kilometers; and for all distances over 100 kilometers 120 pfennigs (28.56 cents).

*Special Tariff II.*—3.5 pfennigs (0.833 cent) per ton-kilometer for all distances, with same terminal charges as above.

*Special Tariff III.*—2.6 pfennigs (0.619 cent) per ton-kilometer up to and including 100 kilometers (62.14 miles), and over 100 kilometers 2.2 pfennigs (0.524 cent) per ton-kilometer, with same terminal charges as above.

In addition to the above special tariffs for wood, there are a number of exceptional rates granted, the most important of which are the following:

Wood specified in Special Tariff III, together with wood waste, such as chips, etc., in carload lots of not less than 10 tons, is carried under the exceptional tariff for raw materials (exceptional tariff 2) unless other exceptional rates apply.

The rates are as follows: Up to 350 kilometers (217.5 miles), 2.2 pfennigs (0.524 cent) per ton-kilometer; over 350 kilometers, 1.4 pfennigs (0.333 cent) per ton-kilometer, with terminal charges of 70 pfennigs (16.66 cents) per ton. The rate for distances over 350 kilo-

meters—450 kilometers, for instance—is calculated up to 350 kilometers at 2.2 pfennigs per ton and for the distance over 350 kilometers at 1.4 pfennigs per ton.

Wood of Special Tariff II is carried under an exceptional tariff, the rate of which is 30 pfennigs (0.714 cent) per ton-kilometer for all distances, with terminal charges from 60 to 120 pfennigs (14.28 to 28.56 cents). This rate applies on the Prussian and most of the other German railways.

In the former district of Bromberg—that is, on the line Kolberg-Belgrad-Wulkowo-Schneidemühl-Posen-Strahlkowo and eastward and Schneidemühl-Berlin-Cüstrin-Frankfort-on-the-Oder, Callies-Arnswalde and Mulkowo-Stargard—wood of Special Tariff II is carried at the following exceptional rate: From 1–100 kilometers (0.62 to 62.14 miles), 3 pfennigs (0.714 cent) per ton-kilometer; 101–200 kilometers (62.76 to 124.3 miles), 2.8 pfennigs (0.666 cent) per ton-kilometer; 201–300 kilometers (124.9 to 186.4 miles), 2.6 pfennigs (0.619 cent) per ton-kilometer; 301–400 kilometers (187 to 248.5 miles), 2.4 pfennigs (0.571 cent) per ton-kilometer; plus terminal charges of 60 pfennigs (14.28 cents) per ton.

For distances over 400 kilometers the rate is 2.2 pfennigs (0.524 cent) per ton-kilometer plus terminal charges of 120 pfennigs (28.56 cents) per ton.

The rate on wood of Special Tariff II in the traffic between the transit stations of the Prussian and Prussian-Saxon lines and the Bavarian, Saxon, and Württemberg stations is from 2.95 to 1.82 pfennigs (0.702 to 0.433 cent) per ton-kilometer, plus terminal charges of 60 pfennigs (14.28 cents) per ton.

This rate was established to meet the competition of the Saxon competing stations.

From the stations of East and West Prussia, east of the Vistula to the East Prussian seaports, wood of Special Tariffs II and III, when intended for export to foreign countries, enjoys the following exceptional rates: Wood of Special Tariff II, 2.2 pfennigs (0.524 cent) per ton-kilometer; wood of Special Tariff III, 1.8 pfennigs (0.428 cent per ton-kilometer, with terminal charges in each case of 60 pfennigs (14.28 cents) per ton.

The rate was established to counterbalance the unfavorable position in which the products of the German forests were placed on account of the low freight rates granted Russian wood intended for export through East Prussian seaports.

Wood named in Special Tariffs II and III, when intended for export and carried distances over 100 kilometers (62.14 miles) from stations of the Prussian railway lines and those of the Southern German and Saxon lines, the exceptional rate is 2 pfennigs (0.476 cent) per ton-kilometer, with terminal charges of from 60 to 120 pfennigs (14.28 to 28.56 cents) per ton. For shipments from Bavaria which are intended for export to Belgium, which pass over the French railway lines, the maximum rate is 1.78 pfennigs (0.424 cent) per ton-kilometer plus the same terminal charges. In the direct traffic to Russia, excepting Poland, the shipper pays no terminal charges, as the German shipping stations receive about 55 pfennigs (13.09 cents) from the Russian terminal charges.

From Sosnowice, on the Russian frontier, to Bavarian stations, wood of Special Tariff III pays an exceptional rate of from 1.81 to

1.23 pfennigs (0.431 to 0.293 cent) per ton-kilometer, with no terminal charges.

The rate was made to meet the competition of foreign railways.

European logs shipped from Frankfort-on-the-Main, Kastel, Gustavsburg, Mayence, and Mannheim to Bavaria and Württemberg have an exceptional rate of 2.7 pfennigs (0.643 cent) per ton-kilometer plus terminal charges of 60 pfennigs (14.28 cents) per ton.

Round timber, more than 20 centimeters (7.87 inches), but not exceeding 30 centimeters (11.8 inches) in diameter, measured at the thinnest end, without bark, and up to 5 meters (16.4 feet) long, intended for mining purposes, when shipped to the mining districts of the Ruhr, Saar-Luxembourg, Alsace-Lorraine, Pfalz, Lahn, Dill, and Siegerland, is carried under exceptional rate for raw material (exceptional tariff 2) given on page 16 of this report.

The exceptional rate for pitch pine, yellow pine, American oak, poplar, and hickory, excepting American black walnut, when shipped from the Rhine and Main transfer stations to Switzerland and beyond, is 3 pfennigs (0.714 cent) per ton-kilometer plus terminal charges of 60 pfennigs (14.28 cents) per ton; regular rate is 4.5 pfennigs (1.07 cents) plus same terminal charges.

The exceptional rate on pitch pine when shipped from the Elbe and Weser ports, and Lübeck to the Swiss transfer stations is about 2.36 pfennigs (0.562 cent) per ton-kilometer, plus terminal charges of 120 pfennigs (28.56 cents) per ton; regular rate, same as above.

The rate was made to enable the above-named German seaports to compete with foreign ports in the traffic via Switzerland.

The exceptional rate on logs, poles, billets, roughly hewn, split, etc., more than 2.5 meters (8.2 feet) long, when shipped from Rhine-Westphalian stations, Hesse-Nassau stations to Belgium and stations on the Northern Railway of France, also between German stations and those of Holland, is, for distances up to 50 kilometers (31.07 miles), 2.7 pfennigs (0.643 cent) per ton-kilometer; above that distance the increment is 2.5 pfennigs (0.595 cent) per ton-kilometer, with a terminal charge of 60 pfennigs (14.28 cents) for all distances. The regular rate is 3 pfennigs (0.714 cent) per ton-kilometer, with the same terminal charge for all distances. The rate was established to increase the consumption of German wood in the countries named.

The exceptional rate on Middle European nut wood and logs from Bavarian and Bavarian-Prussian competition stations to Belgium is 2.4 to 1.46 pfennigs (0.571 to 0.347 cent) per ton-kilometer, the regular rates being 3 pfennigs (0.714 cent) per ton-kilometer; no terminal charges in either case.

The rate was made to complete the competitive rates of the French railways to Belgium.

The exceptional rate on European lumber, etc., from the same shipping stations as above to Holland is 2.4 pfennigs (0.571 cent) per ton-kilometer, plus terminal charges of 60 pfennigs (14.28 cents) per ton, the regular rate being 3 pfennigs (0.714 cent) per ton-kilometer, with the same terminal charges.

The rate was made to increase the exportation of European wood to Holland.

The exceptional rate on wood from Hessian-Nassau stations to French stations is 2.4 pfennigs (0.571 cent) per ton-kilometer, plus

terminal charges of from 60 to 80 pfennigs (14.28 to 19.04 cents) per ton.

To increase the export of German wood to France the exceptional rate on lumber shipped from German stations to Italy is 2.43 pfennigs (3 centimes; 0.578 cent) per ton-kilometer, plus terminal charges of 60 pfennigs (14.28 cents) per ton. The exceptional rate on lumber shipped from Russia to the east and west Prussian seaports for over-sea export to countries outside of Germany is from 2.2 to 1.8 pfennigs (0.524 to 0.428 cent) per ton-kilometer, without terminal charges, the regular rate being 3 pfennigs (0.714 cent) per ton-kilometer, plus terminal charges of 60 pfennigs (14.28 cents) per ton.

The exceptional rate on pine lumber barked of Special Tariff II when shipped from stations of the Province of East Prussia to stations beyond Berlin as far as the Elbe and eastward as far as the line Berlin-Elsterwerda, via Berlin, is 2.2 pfennigs (0.524 cent) per ton-kilometer, plus terminal charges of 120 pfennigs (28.56 cents) per ton. The regular rate is 3.5 pfennigs (0.833 cent) per ton, with the same terminal charges.

The rate was established for the period from December 20, 1908, to December 31, 1911, on account of the damages to trees, caused by the attacks of the nun moth, in the districts for which the favorable rate was made.

### DISCRIMINATION AGAINST AMERICAN PINE.

By an inspection of the rates given in Special Tariffs I, II, and III it will be seen to what extent the Prussian Railway discriminated against American pine. The American wood is classified with the more valuable species, such as ebony, teak, walnut, etc., thus having to pay a higher rate than wood from the Middle European countries.

The American consul at Hanover in a recent report to the Department of State sent several bills of lading, which showed the difference in the rates paid on shipments of American and Swedish pine lumber from several of the German seaports to Hanover. One bill of lading was for a shipment of European pine boards from Bremen to Hanover at a rate of 49 marks ($11.66) per 10 tons (Special Tariff II). Another was for a shipment of American pine boards between the same stations, but the rate was 67 marks ($15.95) per 10 tons. The difference between the two rates per carload of 10 metric tons in favor of the European pine was $4.29, or 36.79 per cent.

On a shipment of Swedish pine from Lübeck to Hanover the freight rate was 80 marks ($19.04) per 10 metric tons, while the rate on American pine was 114 marks ($27.13), or a difference of $8.09 in favor of the European pine, or 42.5 per cent.

On a shipment of sawn pine boards, Swedish wood, from Hamburg to Hanover, per carload of 10 metric tons, the rate paid was 65 marks ($15.47), while on a shipment of American sawn pine boards between the same points the rate paid was 92 marks ($21.90), or a difference in favor of the European lumber of $6.43, or 41.56 per cent.

American oak is now classified with the species named in Special Tariff II, but American pine is still classed with the rare tropical species named in Special Tariff I and has to pay the higher rates of that tariff.

*4. Fertilizers.*

Fertilizers and a great variety of material for the manufacture of artificial fertilizers in the general classification of freight in carload lots of at least 10 tons are classified under Special Tariff III.

The rates as shown in the table of normal rates, given on page 12 of this report, are as follows: 2.6 pfennigs (0.619) cent) per ton-kilometer up to and including 100 kilometers (62.14 miles), and over 100 kilometers, 2.2 pfennigs (0.524 cent) per ton-kilometer, with terminal charges of 60 pfennigs (14.28 cents) per ton for distances up to and including 50 kilometers (31.07 miles); from 51 to and including 100 kilometers (31.7 to 62.14 miles), 90 pfennigs (21.42 cents), and over 100 kilometers, 120 pfennigs (28.56 cents).

In addition to the above there are many exceptional tariffs under which the bulk of the fertilizers used in Germany or exported to foreign countries is transported. The principal exceptional tariffs are as follows:

The rate for manure, gas lime, gypsum, ashes, house and street wastes, oyster and mussel shells, etc., mineral phosphates of all kinds, Thomas slag, Thomas meal, mud deposits from subsiding reservoirs, lime dust, and wool dust, is that of exceptional tariff 2, for raw materials, unless other exceptional rates apply. The rates are as follows: Up to 350 kilometers (217.5 miles), 2.2 pfennigs (0.524 cent) per ton-kilometer; over 350 kilometers, the increment is 1.4 pfennigs (0.333 cent) per ton-kilometer, with terminal charges of 70 pfennigs (16.66 cents) per ton. The regular rate for the above is that of Special Tariff III.

The exceptional rate for raw potash salts, such as bergkieserit, kainit, krugit, sylvinit, etc., potash fertilizer salts, potash magnesium salts, containing a maximum of 42 per cent of potash, and kierserit when used for fertilizing purposes or for the manufacture of artificial fertilizers, is as follows: Up to 200 kilometers (124.27 miles), 2.2 pfennigs (0.524 cent) per ton-kilometer; from 201 to 350 kilometers (124.9 to 217.5 miles) increment, 1.8 pfennigs (0.428 cent) per ton-kilometer; over 350 kilometers (217.5 miles) increment, 1 pfennig (0.238 cent) per ton-kilometer, with terminal charges in each case of 70 pfennigs (16.66 cents) per ton. Regular rate, Special Tariff III.

The exceptional rate for lime dust, marl, beet earth (rübenerde), used for fertilizing purposes or for the manufacture of artificial fertilizers, is as follows: Up to 50 kilometers (31.07 miles), 2.6 pfennigs (0.619 cent) per ton-kilometer; from 51 to 200 kilometers (31.7 to 124.3 miles), 1 pfennig (0.238 cent) per ton-kilometer; over 200 kilometers, 1.4 pfennigs (0.333 cent) per ton-kilometer for the total distance.

Regular rate, Special Tariff III: For fertilizers and raw materials named above, which are used by the German farmers for fertilizing their land or by German manufacturers for the production of artificial fertilizers, there is a reduction of 20 per cent from the above rates.

From the stations of the districts of Frankfort on the Main and Mayence to the Galician-Russian transit stations of Brody, Podwoloczyska, Nadbrzezie, and Nowosielitza, for export to Russia, the rate on the Prussian railways for fertilizers is 1.75 pfennigs (0.417 cent) per ton-kilometer, with terminal charges of 60 pfennigs (14.28 cents) per ton. Regular rates are those of Special Tariff III.

The rate on liquid manure in tank cars from Posen for distances up to 50 kilometers (31.07 miles) is from 2 to 1 pfennigs (0.476 to 0.238 cent) per ton-kilometer, with terminal charges of 60 pfennigs (14.28 cents) per ton. Regular rate, Special Tariff III.

From German and Dutch stations to Russia, excepting Poland, in the Dutch-German-Russian Association and frontier traffic, the rate per ton-kilometer over the German railways for fertilizers mentioned in exceptional rate 2*B* is 1.75 pfennigs (0.417 cent).

In the through traffic there are no terminal charges, as the railways receive a portion of the terminal charges collected by the Russian railways. In the frontier traffic the terminal charge is 30 pfennigs (7.14 cents) per ton.

The fertilizers mentioned above, as classified under Exceptional Tariff 2B, are as follows: Gas-lime, which has been used in the purification of gas, lime dust, sulphate of ammonia (sulphate salts of ammonia), muriate and sulphate of potassium, nitrate of sodium, Chili saltpeter, phosphate of lime, ground bone and bone dust, burnt bones, Thomas cinders, Thomas meal, moss or peat litter, phosphosite and phosphor gypsum (gypsum for fertilizing purposes).

The regular rate on the above fertilizers shipped to Russia is from 2.6 to 2.2 pfennigs (0.619 to 0.524 cent) per ton-kilometer, and terminal charges from 60 pfennigs (14.28 cents) to nothing per ton.

### *5. Grain.*

In the general classification of freight in carload lots of at least 10 tons, grain, including legumes, podded beans, shelled and unshelled, is classified under Special Tariff I. The rates as shown on page 12 of this report are as follows: Forty-five pfennigs (1.071 cents) per ton-kilometer for all distances, with terminal charges of 60 pfennigs (14.28 cents) per ton for distances up to and including 50 kilometers (31.07 miles); from 51 to and including 100 kilometers (31.7 to 62.14 miles), 90 pfennigs (21.42 cents), and over 100 kilometers, 120 pfennigs (28.56 cents) per ton.

When grain is used for seeding purposes it is classed under Special Tariff III. The rates are as follows: Two and six-tenth pfennigs (0.619 cent) per ton-kilometer, up to and including 100 kilometers (62.14 miles), and over 100 kilometers, 2.2 pfennigs (0.524 cent) per ton-kilometer, with same terminal charges as Special Tariff I.

There are many exceptional tariffs for grain, the most important of which are the following:

In the local and direct traffic from stations on the Prussian railways, situated 101 kilometers (62.76 miles) and more from the seaports and frontier stations, grain for export by sea to countries outside of Germany and by the frontiers to France, Belgium, Holland, Switzerland, and Austria-Hungary is transported at the following rates:

Up to 101 kilometers, the regular rate of Special Tariff I, namely, 4.5 pfennigs (1.071 cents) per ton kilometer, the increment from 101 to 400 kilometers (62.76 to 248.5 miles) is 1.43 pfennigs (0.34 cent) per ton-kilometer, and above 400 kilometers, 4.5 pfennigs (1.071 cents), with the same terminal charges as Special Tariff I.

This rate was established to permit German grain produced in the interior districts to take advantage of the favorable tariffs which were granted to grain grown in the seacoast districts and exported to foreign countries.

From East and West Prussia and Posen to Danzig, Königsberg, Memel, Neufahrwasser, and Pillau (local and export traffic) the rate is as follows:

One to 100 kilometers (0.62 to 62.14 miles), 2.6 pfennigs (0.619 cent) per ton-kilometer; 101 to 200 kilometers (62.76 to 124.27 miles), 2.4 pfennigs (0.571 cent) per ton-kilometer; 201 to 300 kilometers (124.9 to 186.4 miles), 2.3 pfennigs (0.547 cent) per ton-kilometer; 301 to 400 kilometers (187 to 248 miles), 2.2 pfennigs (0.524 cent) per ton-kilometers, with terminal charges of from 60 to 120 pfennigs (14.28 to 28.56 cents) per ton.

Over 400 kilometers the rate is the same as given above in the exceptional rate for export. Regular Rate Special Tariff I.

The rate was made for the development of the traffic in native grain to the seaports.

From the Dutch and Belgium ports to the German-Swiss frontier and adjoining stations the rate on grain is about 3.3 pfennigs (0.785 cent) per ton-kilometer, plus a terminal charge of 60 pfennigs (14.28 cents) per ton. In the traffic from Basel for West Switzerland the rate is 2.8 pfennigs (0.666 cent) per ton, with the same terminal charges as above.

The rates were made to meet the competition of the French seaports and French railways.

Between Silesian stations and Berlin and suburbs and between stations of the Berlin-Stettin line the rate on grain is from 4.3 to 3.08 pfennigs (1.02 to 0.733 cents) per ton-kilometer, with terminal charges of from 60 to 120 pfennigs (14.28 to 28.56 cents) per ton. This is an old rate which was retained to keep up the large grain traffic which had developed between the above-named stations. Regular rate is Special Tariff I.

The maximum rate on grain from the Hessian River ports and the river transfer stations, also Frankfort on the Main and Kassel to the Swiss transfer and neighboring stations, is 3.2 pfennigs (0.762 cent) per ton-kilometer, with terminal charges of 60 pfennigs (14.28 cents) per ton.

The rate on grain from Galicia to Danzig and Neufahrwasser for export to foreign countries is 3.17 pfennigs (0.754 cent) per ton-kilometer, with terminal charges of 60 pfennigs (14.28 cents) per ton.

The rate on grain shipped from the Elbe ports, Flensburg and Lübeck, to Danish stations is from 3.62 to 2.85 pfennigs (0.862 to 0.678 cent) per ton-kilometer, with terminal charges of 50 pfennigs (11.90 cents) per ton. The regular rate is from 4.5 to 3.5 pfennigs (1.071 to 0.833 cents) per ton-kilometer, plus terminal charges of 60 pfennigs (14.28 cents) per ton.

Special rates have been granted by the Prussian State Railways for the conveyance of the grain traffic from Russia to oversea countries through the German seaports, Königsberg, Danzig, etc.

The amount which the Prussian Railway receives for carrying grain from Eydtkühnen over its lines to Königsberg, about 700 kilometers (435 miles), is 4.40 marks ($1.047) per ton. Deducting half of the terminal charge of 60 pfennigs (14.28 cents) per ton, the rate is about 2.5 pfennigs (0.595 cent) per ton-kilometer, as against 4.5 pfennigs (1.071 cents) which German grain between the same points has to pay.

In answer to a complaint that the Prussian State Railways were favoring the foreigner at the expense of the home producer, it was pointed out that the specially low rates were granted to secure the traffic to the Prussian railways, as the Russian grain need not necessarily pass over the Prussian lines, but could go via Riga, Reval, and Libau, and would have done so had the rates not been reduced.

## Question III.—Export Rates.

To aid in the expansion of Germany's foreign trade the State railways have made specially low rates for the transportation of goods to the coast ports when intended for export to foreign countries or to the German colonies. All such merchandise, including goods transported exceptionally as fast freight (perishable goods, etc.), even when not shipped in carload lots, is taxed according to Tariff A1 for complete carloads. The rate as shown in tariff of normal rates (p. 12) is 6.7 pfennigs (1.59 cents) per ton-kilometer for all distances, with terminal charges ranging from 100 to 200 pfennigs (23.8 to 47.60 cents) per ton, according to distances, the regular rate being that for piece goods and the special tariff for certain goods shown in the tariff of normal rates (p. 12).

The above rates also apply to shipments from the Russian frontier stations of Alexandrowo and Sosnowice.

In addition to the above there are many exceptional tariffs for goods shipped in carload lots of 10 tons when intended for export. Besides the export rates already given for coal, fertilizers, grain, etc., the following are the most important:

From Dresden to the Elbe and Weser ports, as well as from Dresden and Meissen to Stettin, the rate on condensed milk for export is 4.5 pfennigs (1.071 cents) per ton-kilometer, plus terminal charges of 60 pfennigs (14.28 cents), as against the regular rate of 6 pfennigs (1.428 cents) per ton-kilometer, and the same terminal charges.

New wood boxes shipped from Habelschwerdt and Ebersdorf (district of Breslau) to the German seaports pay a rate of 1.8 pfennigs (0.428 cent) per ton-kilometer, plus terminal charges of 120 pfennigs (28.56 cents) per ton, as against the regular rate of 2.2 pfennigs (0.524 cent), with the same terminal charges. The rate was established to build up the box-making industry of the district mentioned.

### Cotton goods.

Cotton yarn, when shipped from Alsace-Lorraine to the German seaports for export to foreign countries outside of Europe, pay a rate of 2.43 pfennigs (0.578 cent) per ton-kilometer, with terminal

charges of 60 pfennigs (14.28 cents) per ton, the regular rate being 6 pfennigs (1.428 cents) per ton-kilometer, with the same terminal charges.

From the Thuringian, Saxon, and South German stations to the German seaports there are exceptional rates on the products of the shipping districts when intended for export. The rates are given on toys, music, paper goods, bronze powder, small articles made of wood, cane, straw, leather, and metal, glass and wax beads, barometers, thermometers, etc., writing materials, lead and slate pencils, slates, slate blackboards; in other words, Thuringian, Bohemian, and Nuremberg wares. The rates are as follows: 6 pfennigs (1.428 cents) per ton-kilometer up to 100 kilometers (62.14 miles), and for distances above the increment is 3 pfennigs (0.714 cent) per ton, with terminal charges in each case of from 200 to 100 pfennigs (47.6 to 23.8 cents) per ton for 5-ton shipments, and from 120 to 60 pfennigs (28.56 to 14.28 cents) for 10-ton shipments.

To the Dutch and Belgian ports the rate is 5 pfennigs (1.19 cents) per ton-kilometer with terminal charges of 60 pfennigs (14.28 cents) per ton.

The rate on toys and bronze colors is from 5.02 to 4.49 pfennigs (1.195 to 1.069 cents) per ton-kilometer and from 4.50 to 4.49 pfennigs (1.071 to 1.069 cents) per ton-kilometer on slate blackboards when shipped from Bavaria to Holland.

In the traffic from Bavaria to Belgium and Holland through the transfer stations at Frankfort on the Main, Kastel, Gustavsburg, Mayence, Mannheim, and Ludwigshafen the rate on blackboards, etc., is 4.0 pfennigs (0.952 cent) per ton-kilometer with terminal charges of 100 pfennigs (23.8 cents) for 5-ton shipments and 4.0 pfennigs (0.952 cent) to 3.5 pfennigs (0.833 cent) for 10-ton shipments with terminal charges of 60 pfennigs (14.28 cents) per ton.

There are also exceptional export tariffs for the products of the German steel and iron industries.

The rates on iron and steel of Special Tariff I[1] when shipped from the German steel and iron districts to the German North Sea and Baltic ports (local and export traffic) and the coast districts are: From 201 kilometers (124.9 miles) upward, 3.5 to 2.8 pfennigs (0.833 to 0.666 cent) per ton-kilometer with terminal charges of 120 pfennigs (28.56 cents) per ton.

Regular rate, 4.5 pfennigs (1.071 cents) per ton-kilometer, with same terminal charges.

The rate for iron and steel of Special Tariff II[1] from 201 kilometers (124.9 miles) upward, 2.5 to 2.2 pfennigs (0.595 to 0.524 cent) per ton-kilometer with terminal charges of 120 pfennigs (2.856 cents) per ton. Regular rate 3.5 pfennigs (0.833 cent) per ton-kilometer with same terminal charges.

For iron and steel of Special Tariff II for export by sea to non-German European countries, the rate to the German North Sea and Baltic ports is 1.7 pfennigs (0.405 cent) per ton-kilometer with terminal charges of 120 pfennigs (28.56 cents) per ton. The regular rate is 3.5 pfennigs (0.833 cent) per ton-kilometer with the same terminal charges.

[1] The details of the classification of iron and steel in Special Tariffs I, II, and III, may be found on pp. 88–94 of the "Deutscher Eisenbahn-Gütertarif. Teil I. Abteilung B."

From German stations to German seaports for export by sea to other than European countries the rates are as follows: For iron and steel, iron and steel wares of Special Tariff I, brass wares, as well as other complete and half-manufactured articles made from non-precious metals and their alloys, 2.2 pfennigs (0.524 cent) per ton-kilometer, plus 120 pfennigs (28.56 cents) per ton terminal charges. Regular rate, that of Special Tariff I. For iron and steel of Special Tariff II and the following articles of Special Tariff I: Wire rivets, wire, wire strands, wire rope, wire pegs, iron and steel wire; also coppered, barbed wire, chains, screws, nails; also oven shelves and the following parts of stamping mills: Weights, levers, springs, each part to weigh less than 100 kilos (220.46 pounds); wagon axles and component parts (box axle pin, ring, etc.); railway locomotive tenders and steam wagons, railway-car bodies, railroad cars of all descriptions; iron and steel of Special Tariff III of sections 1*a* to *d* of the tariff, up to 400 kilometers (248.5 miles), 1.4 pfennigs (0.333 cent) per ton-kilometer. Over 400 kilometers, the rate calculated for the distance traveled is 1.2 pfennigs (0.286 cent) per ton with terminal charges of 60 pfennigs (14.28 cents) per ton in each case. Regular rates, those of Special Tariffs I, II, and III.

The rate on iron and steel of Special Tariffs I and II from the western foundry districts and the Saar to southwest Germany, Alsace-Lorraine, Baden, Württemberg, including the Swiss frontier and inland station, as well as to Luxemburg:

Special Tariff I, 4 pfennigs (0.952 cent) per ton-kilometer; regular rate 4.5 pfennigs (1.071 cents).

Special Tariff II, 3 pfennigs (0.714 cent) per ton-kilometer; regular rate 3.5 pfennigs (0.833 cent), with terminal charges in each case of 60 pfennigs (14.28 cents) per ton.

From Frankfort on the Main, Gustavsburg, Mayence, and Mannheim to the Swiss frontier and inland stations, the rate on iron and steel of Special Tariffs I and II is the same as above, except that the terminal charges of the exceptional rates are 30 pfennigs (7.14 cents) per ton.

Between German industrial districts and Denmark, the rates on iron and steel of Special Tariff I are:

Up to 300 kilometers (186.4 miles) 3.3 pfennigs (0.785 cent); beyond, 2.8 pfennigs (0.666 cent) per ton-kilometer, with terminal charges in each case of 60 pfennigs (14.28 cents) per ton.

For iron of Special Tariff II and pig iron the rate is 1.7 pfennigs (0.405 cent) per ton-kilometer; terminal charges 60 pfennigs (14.28 cents) per ton.

For the same products from the German foundry districts to Italy, southern France, and the Austrian coast territory, the rates are as follows:

If shipped as piece goods, 4.9 pfennigs (1.166 cents) per ton-kilometer, with terminal charges of 100 pfennigs (23.8 cents).

In 5-ton lots, 3.24 pfennigs (0.771 cent) per ton-kilometer, with terminal charges of 60 pfennigs (14.28 cents) per ton.

In 10-ton lots:

For iron of Special Tariff I, 2.23 pfennigs (0.531 cent) per ton-kilometer; terminal charges 60 pfennigs (14.28 cents) per ton.

For iron Special Tariffs II and III, 1.7 pfennigs (0.405 cent) per ton-kilometer; terminal charges same as above.

From the western foundry stations to Austria-Hungary (also via Regensburg, Deggendorf, and Passau-Donau countries) and from upper Silesia to Austria the rates on iron are as follows:

Iron of Special Tariff I, 2.8 pfennigs (0.666 cent) per ton-kilometer.

Iron of Special Tariff II, 2.2 pfennigs (0.524 cent) per ton-kilometer, with terminal charges of 60 pfennigs (14.28 cents) per ton in each case.

Regular rates 4.5 pfennigs (1.071 cents) and 3.5 pfennigs (0.833 cent) per ton-kilometer, respectively, with same terminal charges. The above exceptional rates also apply to the same products when shipped from the Saar, Lorraine, Luxemburg, and Hessian districts to Austria-Hungary, as well as to Silesia, Saxon, and Austro-Bavarian frontier stations.

From German stations to France the rates are as follows:

Iron of Special Tariff I, 4 pfennigs (0.952 cent) per ton-kilometer; iron of Special Tariff II, 3 pfennigs (0.714 cent) per ton-kilometer; iron of Special Tariff III, 2.06 pfennigs (0.490 cent) per ton-kilometer; with terminal charges of 60 pfennigs (14.28 cents) per ton in each case.

From the German industrial districts to the lower Danube countries (Roumania, Servia, Bulgaria) and beyond, as well as by the through exchange route via Regensburg, Deggendorf, Passau, Vienna, and in the redispatching traffic to the German-Austrian frontier stations, the rates on iron and steel are as follows:

Iron and steel of Special Tariff I, 2.4 to 2 pfennigs (0.571 to 0.476 cent) per ton-kilometer; iron and steel of Special Tariffs II and III, 2 to 1.7 pfennigs (0.476 to 0.405 cent) per ton-kilometer; street railway trucks, 1.23 pfennigs (0.293 cent) per ton-kilometer; with terminal charge of 60 pfennigs (14.28 cents) per ton in each case; regular rates, those of Special Tariffs I, II, and III.

From German and Dutch stations to Russia (excluding Poland) in the through traffic and in the frontier traffic to the frontier stations, the rates on iron and steel are as follows:

*Through traffic.*—Iron and steel of Special Tariff I (10-ton shipments): Up to 612 kilometers (380.3 miles) 3.8 pfennigs (0.904 cent) per ton-kilometer. From 613 to 1,015 kilometers (380.9 to 630.7 miles) 3.5 pfennigs (0.833 cent) per ton-kilometer. From 1,016 kilometers (631.3 miles) 3.2 pfennigs (0.762 cent) per ton-kilometer, with no terminal charges.

Iron and steel of Special Tariff II (10-ton shipments): Up to 1,015 kilometers (380.9 miles) 3.5 pfennigs (0.833 cent) per ton-kilometer. Over that distance, 3.2 pfennigs (0.762 cent).

Iron and steel of Special Tariff III (10-ton shipments): Up to 100 kilometers (62.14 miles) 2.6 pfennigs (0.619 cent) per ton-kilometer. Over 100 kilometers 2.2 pfennigs (0.524 cent) per ton-kilometer, with no terminal charges in each case.

FRONTIER TRAFFIC.

*Special Tariff I.*—Same as above for northern Russia, except terminal charges are 30 pfennigs (7.14 cents) per ton. For middle and southern Russia, 2.7 pfennigs (0.643 cent) per ton-kilometer, with same terminal charges.

*Special Tariff II.*—For northern Russia, same as through traffic, except the terminal charges are 30 pfennigs (7.14 cents) per ton. For middle and southern Russia, 2.2 pfennigs (0.524 cent) per ton-kilometer, with the same terminal charges.

*Special Tariff III.*—For northern Russia, same as through traffic, except terminal charges are 60 pfennigs (14.28 cents) per ton. For middle and southern Russia, the rate is 1.75 pfennigs (0.417 cent) per ton-kilometer, with terminal charges of 30 pfennigs (7.14 cents) per ton.

From French and Belgian stations to Russian stations (excepting Poland), same as above, without terminal charges.

For agricultural machines and implements from German and Dutch stations to Poland in the through traffic and in frontier traffic to the frontier stations, in order to support the German competition for traffic with Poland, the same rates are charged as for the traffic to middle and southern Russia.

From the German iron industry districts to Dutch and Belgian ports, as well as for stations on the Dutch coast to Germchen and Utrecht, the rates are:

For iron of Special Tariff I, 3.5 pfennigs (0.833 cent) per ton-kilometer.

For iron of Special Tariff II (also for armor plates from Magdeburg to Amsterdam and Rotterdam), 2.2 pfennigs (0.524 cent) per ton-kilometer, with terminal charges of 60 pfennigs (14.28 cents) in each case.

Regular rates, 4.5 pfennigs (1.071 cents) and 3.5 pfennigs (0.833 cent), respectively.

From Upper Silesia to the shipping stations of the Hungarian River & Sea Shipping Co. (Ungarischen Fluss und Seeschiffahrt Gesellschaft) on the lower Danube via Pressburg the following are the rates:

Iron of Special Tariff I and agricultural machinery: Up to 100 kilometers (62.14 miles), 2.4 pfennigs (0.571 cent) per ton-kilometer; 101–200 kilometers, 2.3 pfennigs (0.547 cent).

Iron of Special Tariff II: 2 pfennigs (0.476 cent) and 1.9 pfennigs (0.452 cent), respectively, with terminal charges of 60 pfennigs (14.28 cents) per ton in each case.

Regular rates, 4.5 pfennigs (1.071 cents) and 3.5 pfennigs (0.833 cent), respectively.

Between Leipzig (Prussian railway station) and Plagwitz-Lindenau and Austro-Hungarian stations the rate on field and agricultural machinery and implements is 2.2 pfennigs (0.524 cent) per ton-kilometer, with terminal charges of 60 pfennigs (14.28 cents) per ton. Regular rate, 45 pfennigs (1.071 cents) per ton-kilometer, with same terminal charges.

In addition to the exceptional rates for export, there are many reduced rates on raw materials and other products when imported into Germany. For instance, between German, Belgian, and Dutch ports and Austro-Hungarian cities, such as Prague, Vienna, Budapest, etc., and between German seaports and the Bavarian-Danube

transfer stations, and between Denmark, Sweden, and Norway and Austria-Hungary the rates are as follows:

Coffee, cocoa, gutta-percha, pepper, nuts (excepting walnuts and hazelnuts), dyewood extracts, quebracho and other extracts, hides and skins, etc.: About 3.8 pfennigs (0.904 cent) per ton-kilometer. Regular rates, 6 pfennigs (1.428 cents) and 4.5 pfennigs (1.071 cents), respectively, with terminal charges in each case of 60 pfennigs (14.28 cents) per ton.

Fats, tallow, lard, etc.: About 3.74 pfennigs (0.890 cent) per ton-kilometer. Regular rates and terminal charges same as above.

Raw cotton, cotton waste, etc.: Up to 3 pfennigs (0.714 cent) per ton-kilometer, with terminal charges of 60 pfennigs (14.28 cents) per ton. Regular rate, 4.5 pfennigs (1.071 cents), with same terminal charges.

Between German seaports and southwestern Germany (Frankfort-on-Main and beyond), Bavaria, and Switzerland the rates are as follows:

Coffee, pepper, raw tobacco, tea, cheese, milk, gutta-percha, caoutchouc, wine, etc.: 3.68 pfennigs (0.876 cent) per ton-kilometer, with terminal charges of from 60 to 120 pfennigs (14.28 to 28.56 cents) per ton. Regular rate, 6 pfennigs (1.428 cents) per ton-kilometer, with same terminal charges.

Cotton and cotton-yarn waste: 3.09 pfennigs (0.735 cent) per ton-kilometer. Regular rate, 4.5 pfennigs (1.071 cents), with same terminal charges as above.

For many of the export and import rates there are no fixed bases; the values are made in the interests of the German sea trade, for the advancement of the German ports, and for the building up of German industries.

For coffee, coffee substitutes, hides and skins, tobacco, tallow, etc., from the North Sea ports to Westphalia there is a rate of 3.3 to 3.9 pfennigs (0.785 to 0.928 cent) per ton-kilometer, with a terminal charge of 120 pfennigs (28.56 cents) per ton, against a regular rate of 4.5 to 6 pfennigs (1.071 to 1.428 cents) per ton-kilometer, with the same terminal charges. The rates on petroleum from the German North Sea ports and Lübeck, Peine, and Salzbergen to Rheinland-Westphalia are about 2.2 pfennigs (0.524 cent) per ton-kilometer, with terminal charges of from 60 to 120 pfennigs (14.28 to 28.56 cents) per ton, as against normal rates of 6 pfennigs (1.428 cents) per ton, with the same terminal charges. This rate was made to compete with the Belgian and Dutch seaports.

The rate on refined petroleum from Russia to German stations east of the Elbe, including Dresden, Leipzig, Halle, Magdeburg, etc., is from 2.6 to 2.2 pfennigs (0.619 to 0.524 cent) per ton-kilometer, with terminal charges of 60 pfennigs (14.28 cents) per ton.

On petroleum, cleaned and raw, from Roumania to the same stations 2.2 pfennigs (0.524 cent) per ton-kilometer, and from Austria-Hungary the same as the rate from Russia given above, with terminal charges in each case of 60 pfennigs (14.28 cents) per ton.

In the following statement are shown the export rates on several classes of goods from certain cities to the principal German seaports, together with the normal rates for the same distances:

*Export rates per metric ton (2,204.6 pounds) on several classes of goods on German railways, in carload lots of 10 tons.*

| From— | To— | Distance. | | Class of goods. | Export rate. | | Normal rate. | |
|---|---|---|---|---|---|---|---|---|
| | | Kilometers. | Miles. | | Marks. | Dollars. | Marks. | Dollars. |
| Cologne | Hamburg | 430 | 267.2 | Copper goods, lead in blocks; tubes. | 13.20 | 3.14 | 26.80 | 6.38 |
| Do | do | 430 | 267.2 | Zinc in sheets, etc. | 13.30 | 3.17 | 20.40 | 4.86 |
| Do | do | 430 | 267.2 | Cotton goods | 15.30 | 3.64 | 26.80 | 6.38 |
| Do | do | 430 | 267.2 | Machinery and machine parts; ironwares. | 10.60 | 2.52 | 20.40 | 4.86 |
| Do | do | 430 | 267.2 | Iron plates, locomotives, etc. | 5.60 | 1.33 | 16.10 | 3.83 |
| Frankfort | do | 532 | 330.6 | Machines and ironwares. | 12.90 | 3.07 | 25.20 | 6.00 |
| Do | Bremen | 459 | 285.2 | do | 11.30 | 2.69 | 21.90 | 5.21 |
| Do | Lübeck | 577 | 358.5 | do | 13.90 | 3.31 | 27.20 | 6.47 |
| Do | Hamburg | 532 | 330.6 | Iron products, such as beams, etc. | 7.00 | 1.67 | 19.80 | 4.71 |
| Do | Bremen | 459 | 285.2 | do | 6.10 | 1.45 | 17.30 | 4.12 |
| Do | Lübeck | 577 | 358.5 | do | 7.50 | 1.79 | 21.40 | 5.09 |
| Nuremberg | Hamburg | 635 | 394.6 | Thuringian wares, toys, etc. | 24.50 | 5.83 | 39.20 | 9.33 |
| Do | Bremen | 583 | 362.3 | do | 22.90 | 5.45 | 36.40 | 8.66 |
| Do | Lübeck | 652 | 405.1 | do | 25.30 | 6.02 | 40.50 | 9.64 |

The above export and import rates are for the hauling of the goods to and from the station at the port, and an additional charge must be paid for the haulage over the dock line, which in most cases is the property of the town. This charge varies from 1.50 marks (35.70 cents) to 3 marks (71.40 cents) per car, according to circumstances.

A large number of exceptional tariffs closely affect the trade through the ports, as one of the principal objects of the tariffs is to secure the traffic to the German railways. These rates are based as far as possible on the competitive rates through the ports of Belgium and Holland, often irrespective of the kilometric distance.

The export rates apply only to merchandise shipped through the ports for consumption in foreign countries or in the German colonies; for merchandise for native use the local rates apply.

To enjoy the benefits of the reduced rates it must be satisfactorily proved to the railway authorities that the goods in question are actually intended for export.

## Question IV.—Express Freight.

As stated before in this report, in the classification of goods in the freight tariff, when piece goods are shipped by fast freight (eilgut) the rates charged are double those for ordinary freight, and when the merchandise is forwarded by fast freight in complete carloads it pays double the rates prescribed for complete carloads in the classes A and B.

There are also lists of specified articles which are forwarded by fast service at slow-service rates, whether the goods be consigned as piece goods or in carloads. Such articles are bees, bread, butter, fish of various descriptions, shellfish, etc., certain kinds of vegeta-

bles, milk and cream, fresh berries, stone fruit, grapes, and various plants, etc.

The fast-freight class includes all articles sent at the discretion of the railway authorities either by regular passenger or by fast-freight trains.

There is, in addition to the fast freight, a special fast-freight class, which probably corresponds more nearly to the American express service. The goods take precedence of fast-freight goods and are forwarded by the most favorable trains, specified for the purpose by the railway authorities. The rates for piece goods, including the specified articles mentioned above, are double the ordinary fast-freight class rates, and if shipped in carloads four times the rate for the slow carload classes A 1 and B.

The bases of these rates are given in the normal tariff rates, page 11 of this report. In general, it may be stated that fast freight costs twice as much and special fast freight four times as much as when shipped as ordinary freight.

The following are examples illustrative of fast freight tariffs for piece goods from Chemnitz to various points:

| Place. | Distance. | | Fast freight. | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Kilometers. | Miles. | Transportation. | | Terminal charges. | | Total. | |
| | | | *Mks.* | *Dols.* | *Mks.* | *Dols.* | *Mks.* | *Dols.* |
| Leipzig | 86 | 53 | 1.82 | 0.43 | 0.36 | 0.09 | 2.18 | 0.52 |
| Halle | 116 | 72 | 2.42 | .58 | .40 | .10 | 2.82 | .67 |
| Berlin | 220 | 137 | 4.46 | 1.06 | .40 | .10 | 4.86 | 1.16 |
| Nurnberg | 312 | 194 | 6.10 | 1.45 | .40 | .10 | 6.50 | 1.54 |
| Breslau | 351 | 218 | 6.72 | 1.60 | .40 | .10 | 7.12 | 1.69 |
| Munich | 464 | 288 | 8.40 | 2.00 | .40 | .10 | 8.80 | 2.09 |
| Mannheim | 521 | 324 | 9.16 | 2.18 | .40 | .10 | 9.56 | 2.28 |
| Friesenhofen | 585 | 364 | 9.92 | 2.36 | .40 | .10 | 10.32 | 2.45 |
| Freiburg | 696 | 432 | 11.26 | 2.68 | .40 | .10 | 11.66 | 2.78 |
| Königsberg | 776 | 482 | 12.22 | 2.91 | .40 | .10 | 12.62 | 3.00 |

| Place. | Rates per 100 kilograms (220.4 pounds), special fast freight. | | | | | |
|---|---|---|---|---|---|---|
| | Transportation. | | Terminal charges. | | Total. | |
| | *Mks.* | *Dols.* | *Mks.* | *Dols.* | *Mks.* | *Dols.* |
| Leipzig | 3.64 | 0.87 | 0.72 | 0.18 | 4.36 | 1.04 |
| Halle | 4.84 | 1.15 | .80 | .20 | 5.64 | 1.34 |
| Berlin | 8.92 | 2.12 | .80 | .20 | 9.72 | 2.31 |
| Nurnberg | 12.20 | 2.90 | .80 | .20 | 13.00 | 3.09 |
| Breslau | 13.44 | 3.20 | .80 | .20 | 14.24 | 3.39 |
| Munich | 16.80 | 4.00 | .80 | .20 | 17.60 | 4.19 |
| Mannheim | 18.32 | 4.36 | .80 | .20 | 19.12 | 4.55 |
| Friesenhofen | 19.84 | 4.72 | .80 | .20 | 20.64 | 4.91 |
| Freiburg | 22.52 | 5.36 | .80 | .20 | 23.32 | 5.55 |
| Königsberg | 24.44 | 5.82 | .80 | .20 | 25.24 | 6.01 |

It should be noted that so far as small parcels are concerned, the great part of the express business for Germany is done through the post office, per parcels post. The weight of a package must not exceed 50 kilograms (110.2 pounds).

The rates are as follows: Up to and including 5 kilograms (11 pounds): Up to 10 miles, 25 pfennigs (5.95 cents); all distances above 10 miles, 50 pfennigs (11.90 cents). Packages weighing over 5 kilograms (11 pounds): For the first 5 kilograms as above; for each additional kilogram (1.1 pounds) or part thereof, up to 10 miles, 5 pfennigs (1.19 cents); from 10 to 20 miles, 10 pfennigs (2.38 cents); from 20 to 50 miles, 20 pfennigs (4.76 cents); from 50 to 100 miles, 30 pfennigs (7.14 cents); from 100 to 150 miles, 40 pfennigs (9.52 cents); over 150 miles, 50 pfennigs (11.90 cents).

The above rates are valid also for places in Austria-Hungary.

## Question V.—Typical Classified Products.

In the following statement are given the normal and special rates charged on most of the German railways on typical products included in the various categories of the regular freight classification showing both carload and less than carload rates.

*Freight rates on the German railway systems per 100 kilograms (220.46 pounds) including terminal charges.*

[Not in carload lots.]

| From Nuremberg to— | Distance. | Fast freight. | General freight. | Special freight. | General carload rates. | | | Special carload rates. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | A1. | B. | A2. | I. | II. | III. |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | *Miles.* | | | | | | | | | |
| Hamburg | 394.57 | $2.60 | $1.30 | $1.26 | $1.06 | $0.94 | $0.79 | $0.71 | $0.56 | $0.36 |
| Stettin | 387.73 | 2.57 | 1.28 | 1.24 | 1.04 | .92 | .77 | .70 | .55 | .35 |
| Berlin | 296.39 | 2.14 | 1.07 | .96 | .81 | .71 | .60 | .54 | .43 | .28 |
| Leipzig | 200.70 | 1.59 | .79 | .66 | .56 | .49 | .41 | .37 | .30 | .20 |
| Chemnitz | 193.87 | 1.55 | .77 | .64 | .55 | .47 | .40 | .36 | .29 | .19 |
| Crefeld | 311.93 | 2.22 | 1.11 | 1.00 | .85 | .74 | .63 | .57 | .45 | .29 |
| Frankfort on the Main | 149.13 | 1.24 | .62 | .50 | .43 | .37 | .31 | .29 | .23 | .15 |
| Strassburg | 210.02 | 1.64 | .82 | .69 | .59 | .51 | .43 | .39 | .31 | .20 |
| Stuttgart | 118.68 | 1.03 | .51 | .41 | .35 | .30 | .26 | .23 | .19 | .13 |
| Coburg | 72.08 | .67 | .34 | .27 | .23 | .20 | .17 | .15 | .13 | .09 |

The rates for shipments of all goods in less than carload lots are shown in columns 1, 2, 3.

Fast freight, column 1: The rates given are double those for general freight in column 2, and include terminal charges of 40 pfennigs (9.52 cents) per 100 kilograms (220.46 pounds).

General freight, column 2: The rates include terminal charges of 20 pfennigs (4.76 cents) per 100 kilograms.

Special freight, column 3: The rates are for certain articles, including bicycles, motor cycles, etc., potatoes, oil cakes, clover, etc., machinery and agricultural implements, grain of all descriptions, iron and steel of all descriptions, nails, salts, seeds, shoe blacking, earthenware, etc. Terminal charges amounting to 20 pfennigs (4.76 cents) are included in the rates.

A1, column 4: The rates are for all goods in consignments of 5 tons and include terminal charges of 20 pfennigs (4.76 cents) per 100 kilograms.

B, column 5: The rates are for 10-ton consignments and include terminal charges of 12 pfennigs (2.86 cents) per 100 kilograms.

A2, column 6: Are the rates for 5-ton consignments of such articles as are included under Classifications I and II, columns 7 and 8, and include terminal charges of 12 pfennigs (2.86 cents) per 100 kilograms.

Special Tariff I, column 7: Are the rates for shipments in 10-ton carload lots of certain articles, such as raw cotton, lead, iron and steel wares of all descriptions, field and garden fruits, grain, glass, seeds, raw sugar, etc., and include terminal charges as above.

Special Tariff II, column 8: Are the rates for shipments in 10-ton carload lots of asphalt, railway locomotives and tenders and truck bodies, flax, hemp, jute, stone, etc., and include terminal charges as above. These rates are also for 5-ton shipments of articles classified under Special Tariff III.

Special Tariff III, column 9: These are the rates for waste products, coal, fertilizers, ice, railway cars of all descriptions, chemical colors, ores, etc., and include terminal charges as above.

The above are the general rates. In addition there are many exceptional rates for shipments in carload lots, the most important of which have already been given under the various sections of this report.

## Question VI.—Basis of Freight Rates.

By an inspection of the table of normal rates, page 11 of this report, it will be seen that there is a single unit for all distances for shipments of goods comprised in the special piece-good class and wagonload classes A1 to and including Special Tariff II, while for Special Tariff III there are two units for distances up to and including 100 kilometers (62.14 miles) and over 100 kilometers.

In the general class of piece goods, as well as the general and special class of fast-freight goods, the rates up to and including 500 kilometers (310.7 miles) are based on a sliding schedule, with more favorable rates for the greater distances. With varying distances, up to and including 100 kilometers (62.14 miles), the terminal charges are also based on a sliding scale. Over that distance they are uniform, according to the various classifications of goods.

Based on kilometric distances, the German railway tariff scheme would appear to possess all the elements of simplicity. Knowing the distance and the classification, all that would be necessary would be to consult the kilometric tables of rates, but the proper classification presents a certain measure of difficulty, and in many cases considerable research is required if the cheapest rate is to be found. The greatest difficulty of all, however, lies in the many exceptional tariffs that have come into existence to further the German traffic in competition with the railways and waterways of neighboring countries and to develop the German industries. In certain of these tariffs for export and import no direct bases can be given, as the rates are dictated by circumstances.

Germany is fully alive to the fact that transportation facilities are the very foundation of the industrial prosperity of any country, and appreciates the advantage of a complete and unified system of internal transport both by land and water.

Prussia has a definite policy of rendering assistance to her industries and has used her railways and waterways to this end. By the establishment of exceptional tariffs, facilities have been created for cheap through traffic, for the cheap delivery of the raw materials needed in the industries and for the cheap distribution of the native-finished products. To encourage German shipbuilding important concessions have been granted in the freight rates on raw and finished materials for ship construction and repair.

The Prussian railway administration in 1908 lowered its regular freight tariffs for 64 per cent of the traffic in order to serve the exigencies of trade—especially export trade during a period of depression.[1]

By the nationalization of her railways Germany has been enabled, in a wonderfully short period, to increase the productive power of the Empire, to further its commercial interests by land and sea, to create new markets, and extend those already existing, and thus to promote the welfare of the German people.

[1] Elmer Roberts, "Monarchical Socialism in Germany," Scribner's Magazine, January, 1910.

## Chapter II.

# INLAND WATERWAYS AND CANALS IN GERMANY.

### I. PUBLIC SUPERVISION.

(*a*) In general terms the expense for the improvement of the waterways of Germany, including original construction and maintenance, is borne by the several States, and with but few exceptions the canals and waterways are state-owned. Among the exceptions may be mentioned the following:

1. The Teltow Canal, constructed and administered by the district of Teltow.
2. The Euster Canal, joining the Havel at Brandenburg.
3. The Lehnitz Canal, connecting the upper Havel at Oranienburg with Lake Lehnitz.
4. The canalized Notte, a tributary of the upper Spree.

The three last waterways, however, are only of local importance and are owned by private companies.

Harbors of refuge for shipping during the periods of flood and ice and for passing the winter are also constructed and maintained by the States, but inland harbors of commerce with certain exceptions are usually constructed and administered by the municipalities, corporations, and other interested parties, who as a rule also own the sheds, warehouses, and plant.

The following are the principal traffic harbors belonging to the State of Prussia: The harbor of Duisburg-Ruhrort, the largest inland harbor in Germany, the harbor of Cosel on the Oder, especially constructed for the transshipment of coal and in connection with the canalization of the upper Oder, the raft harbor at Brahemünde on the Vistula, and several smaller harbors on the Oder, the Elbe, etc.

The improvement of land in Prussia by irrigation, drainage, reclamation, and the construction of dikes, when connected with unnavigable streams and rivers, is under the supervision and control of the Prussian ministry of agriculture, domains, and forests. All works, however, constructed for the purpose of improving the navigation of rivers and streams come within the province of the ministry of public works. When such works result in the reclamation of land or are used in connection with irrigation or drainage, the ministry of agriculture, domains, and forests is consulted and bears its proportionate share of the costs of the preliminary plans and of the execution of the work according to agreement in each particular case. The funds for the improvement and maintenance of waterways are in general provided for in the annual budgets or by special laws.

The head of the whole system of administration of the state-owned waterways of Prussia is the minister of public works, in whose ministry there is a special department established for the purpose. Under the minister the administration in the Provinces is in general in the hands of the provincial governors (Regierungs-Präsidenten), but for the large rivers special boards have been created, the chiefs of which are the provincial governors-general of the different Provinces, namely, for the Rhine, the Rhine board, with its head office at Coblenz; the board for the Dortmund-Ems Canal and the Ems, with its head office at Münster; the Weser River board, with its head office at Hanover; the board for the Elbe, with its head office at Magdeburg; for the Oder the Oder River board, with its head office at Breslau, and for the Vistula the Vistula board, with head office at Danzig.

In addition to the above there is a board of administration of the waterways of the Mark of Brandenburg, which include waterways lying outside of the government district of Potsdam. This board is not subordinate to the governor-general of the Province of Brandenburg, but its head is the governor in Potsdam. The waterways in the immediate neighborhood of Berlin are under the administration of the ministry of public works.

The provisional governors are assisted in the management of the waterway construction, improvement, and engineering works by technical and legal advisers.

For the local management, there are suboffices in charge of inspectors of waterways, that are responsible for the execution of the works and for the river police. Attached to the suboffices are the necessary officials, secretaries, overseers, lock, weir, and bridge keepers, etc.

The length of waterways allotted to each suboffice varies between 40 and 50 miles.

For the specially important work now in course of construction extra engineers, counselors, and architects are employed according to need. At the present time the extra officials are employed on the canal construction board at Essen, on that at Hanover, and on the principal construction board at Potsdam.

On the Rhine there is also an international commission composed of representatives of the various Rhine States, Prussia, Hessia, Baden, Bavaria, and Alsace-Lorraine.

In accordance with the law of February 25, 1907, to assist in the execution of the provision of the Prussian law of April 1, 1905, for the construction of new waterways and the improvement of those already existing, advisory councils have been appointed by the State, in which the Government and the commercial, navigation, agriculture, fishing, and other interests are represented by members or their substitutes. Not more than one-third of the members may be in the direct employment of the State. The city of Bremen, as a financial supporter of the Rhine-Weser Canal, has a right to two members.

There are six of these councils for the various sections of the works. After the new works on the canal sections from the Rhine to the Weser and to Hanover are completed, the three advisory councils which were appointed for these sections will be consolidated

into one, and when the work is completed on the other sections the advisory councils for those sections will also be consolidated into one council.

To these councils are referred:

First. The general plans for the execution of the work as set forth in the law, and the objections, if any, of participating districts (Kreise).

Second. The annual reports of the work done, mentioning the more important questions which may have arisen during the execution of the work and any objections which may have arisen.

Third. The measures for the maintenance and improvement of the navigable waterways and the promotion of traffic on the same.

Fourth. The grounds on which applications for permits to construct inland harbors of commerce have been made.

Fifth. Questions relating to tolls, freight rates, and classification of freight.

Sixth. Police traffic regulations and regulations for a uniform towing service.

Seventh. Questions regarding the welfare of workmen engaged in the construction of the waterways and in the navigation traffic.

Above the advisory councils there is a general council composed of a president and a substitute, appointed by the King of Prussia, a member from each of the six advisory councils, and a certain number of members appointed by the minister for a period of three years. In no case may more than one-third of the total membership consist of officials in the direct employment of the Government.

To the general council are referred all matters of more importance than those which would come under the supervision of the district councils. The results of the deliberations of the general council are laid before the minister of public works, who in turn submits them to the Prussian Parliament.

According to the law, the general council may be divided into two sections, one for the western and one for the eastern waterways, but up to the present time this has not been done.

(*b*) 1. The above-mentioned officials have neither a direct nor indirect influence upon the capitalization of navigation corporations nor upon the regulation of the freight rates. In general it is not customary for the various officials to make yearly reports; however, for statistical purposes, reports of the progress of the work under construction during the past year are published in the Official Journal for Building Operations (Zeitschrift für Bauwesen). Besides it is usual, after the completion of an important work, to publish a report in the above-mentioned journal. In this journal also are published from time to time descriptions of the less important building operations, but all of the reports are more of a private than of a public character.

According to the law of April 1, 1905, before mentioned, it is obligatory upon the King of Prussia twice in each year to read a report from the throne upon the progress which has been made in the work upon the new and improved canals and waterways. As stated before, the state builds the canals and improves the waterways and also the safety harbors. The inland harbors of commerce on the canals and rivers and terminals are with but few exceptions

constructed and maintained by the municipalities, districts, and other interested parties. The seaports and harbors are mostly the property of the state.

2. Statistics of water-borne traffic in general are collected by the imperial authorities, assisted by the officials of the various states, counties, and the navigation companies, and published by the imperial statistical bureau. This bureau publishes each year a special volume containing statistics of the water traffic, of the conditions which prevailed in the various canals and waterways at the end of each year, and the number of steamers, barges, and towing vessels registered at the end of each five years. Several of the states, especially Prussia, publish guidebooks for the German waterways.

### II. WATERWAY IMPROVEMENTS.

(*a*) In Germany there is no established policy as to water power developed by works constructed for improving navigation. Recently, however, the value of the water power developed in the canalization of rivers and other improvements has been recognized. Reservoirs have been constructed by private corporations, where the main object was to obtain the power for electrical purposes. In the new reservoirs which are being specially erected by the state in Silesia as a protection against floods, and in the large reservoirs authorized by the law of 1905, on the Eder and Diemee for the feeding of the Rhein-Weser Canal and for improvement of the navigation on the Weser, the water power is to be utilized. Specific examples of the utilization of water power on rivers are the power plants at the new Weser weir at Hemelingen, near Bremen, and at Dörverden, county of Moya. The former is described in detail in the report of the American consul at Bremen, which is forwarded with this report. The power at the Dörverden weir is to be utilized for the generation of electricity, which is to be conducted by overhead wires to Minden to run a pumping station at that place to feed the Rhein-Weser Canal and thereby save the construction of an expensive water conduit and also for furnishing power to a private electric corporation.

Attention is called to a work prepared by the ministry of public works, called "Die Speisung des Rhein-Hannover Kanals," which contains interesting information and data regarding the utilization of water power at Dörverden.

(*b*) As stated before, in answer to Question I (*a*), river improvements, including original construction and maintenance, are undertaken by the several states, and with but few exceptions the canals and waterways are state-owned. The exceptions are noted in the answer to the said question.

In general the funds for the execution of public works are granted by the state and are covered out of the current revenue or by special loans sanctioned by law, and in certain cases in combination with contributions by provinces, districts, communities, and other interested parties.

As an example, the carrying out of the new works which are now being constructed by the Prussian Government under the provisions of the law of April 1, 1905, is made conditional on dues being levied by the State, and (1) on the Provinces and other public corporations interested, undertaking a guaranty for the cost of the administra-

tion, working and maintenance not covered by the shipping dues and other revenues on these waterways to the annual amount of $861,346, less the supplementary maintenance of the improvements on the Dortmund-Ems Canal and the present cost of maintenance on the Freie Netze, on the Oder-Vistula waterway, and on the canalized Oder, amounting in all to $90,583, leaving $770,763; (2) on the State of Bremen, besides undertaking to carry out certain works on the Weser at its own expense, to contribute also one-third of the cost of the impounding reservoirs on the Weser Basin and of the regulation works below Hameln to the amount of $1,570,000; (3) on the Provinces and public corporations interested further undertaking a guaranty for the interest at 3 per cent, and commencing with the sixteenth year for one-half per cent to the sinking fund, on about one-third of the cost of the respective sections of the works, in so far as the current revenue on the respective section of the canal after deducting the expenses of administration, working, and maintenance does not suffice to cover the amount for interest and amortization, with some alleviations as to the amount of interest during the first ten years. The amount of the annual interest guaranteed is estimated at $735,063, and of the annual contribution to the sinking fund, starting in the sixteenth year, at $122,500. As soon as the revenue of the respective section exceeds the amount necessary to cover the expense of administration, working and maintenance, and of interest and amortization, the surplus is to be used, first, for the further amortization of capital; secondly, for the interest and amortization on capital already expended on certain works of improvement; and, thirdly, after the amortization of capital is completed, for the reimbursement of all deficits of previous years, on administration, working, maintenance, etc., and as on interest borne by the State and by the contributory parties under their guaranty.

In other words, the Provinces and interested parties guarantee:

(1) The cost of maintenance, working, and administration;

(2) With certain alleviations, 3 per cent interest on about one-third of the capital; and

(3) From the sixteenth year onward one-half per cent to the sinking fund, the State undertaking to find the money for the interest and sinking fund for the remaining two-thirds of the capital.

### III. FLOATING EQUIPMENT.

(1) to (4). In the following official statistics are included all freight and passenger ships, with and without motive power, used as common carriers of goods and passengers on the German inland waterways of a capacity of 10 metric tons and over. The statistics do not include vessels employed in the government service or those used by private parties for pleasure purposes only.

On December 31, 1907, there were engaged in the inland navigation of Germany 26,235 vessels of different kinds, of a capacity of 5,914,020 tons, of which 22,923 vessels of 5,725,258 tons were without propelling power and 3,312 vessels of 188,762 tons had their own means of propulsion. Of the latter there were 1,067 passenger vessels, including 4 with electric power; 642 freight boats, including 45 with electric motors; 1,558 towing tugs, including 1 with

electric power; and 45 chain-towing vessels. There were 14,547 boats built of wood, and 11,688 of iron, steel, or other materials.

Of 26,191 vessels, 7,393 had a carrying capacity of less than 50 tons; 3,537 of from 50 to 100 tons; 1,859 of from 100 to 150 tons; 6,301 of from 150 to 250 tons; 3,122 of from 250 to 400 tons; 1,867 of from 400 to 600 tons; 899 of from 600 to 800 tons; and 1,213 of from 800 tons and over.

There were 2,571 vessels of 168,569 tons propelled by steam, with a boiler capacity of 179,582 square meters, and indicated horsepower of 479,344. In addition to the steam vessels there were 700 vessels with explosion motors, with a capacity of 6,112 horsepower. Of these, 351, with 3,345 horsepower, were for passenger service; 327, with 2,571 horsepower, for carrying freight; and 22, with 196 horsepower, for towing. There were also 50 vessels with electric propulsion, with a capacity of 347 kilowatts.

In the navigation of the inland water system the following are the general classes of barges used:

The Finow Canal boats are on an average 40.2 meters (131.9 feet) long, 4.6 meters (15.1 feet) broad, 2 meters (6.6 feet) high, and with a draft of 1.4 meters (4.6 feet), having a carrying capacity of 170 tons.

The Oder boats are on an average 55 meters (180.4 feet) long, 8 meters (26.2 feet) broad, 2 meters (6.6 feet) high, with a carrying capacity of from 400 to 500 metric tons on a draft of 1.7 meters (5.6 feet).

The Elbe boats on an average are 65 meters (213½ feet) long, 8 meters (26.2 feet) broad, 2 meters (6.6 feet) high, with carrying capacities of 300, 480, and 600 tons, with drafts of 1 meter (3.3 feet), 1.4 meters (4.6 feet), and 1.7 meters (5.6 feet), respectively.

The Rhine boats on an average are 237 feet long and 30.6 feet beam with carrying capacities of from 460 to 1,000 tons on drafts of 4, 5, 6, 7, and 7½ feet, respectively.

According to information furnished by the American consul-general at Frankfurt, in 1908 the Rhine fleet consisted of 1,318 steam vessels with indicated horsepower of 295,849 and 9,759 barges with a carrying capacity of 3,960,378 tons, or 11,077 vessels in all. Of these the German craft included 632 steam vessels with 188,690 indicated horsepower and 2,800 barges with a carrying capacity of 1,881,261 metric tons, or a total number of 3,432 vessels. Of the 9,759 barges, 6,637 with a carrying capacity of 3,443,297 tons were built of iron or steel and 3,122 with a capacity of 517,081 tons of wood. The largest vessel plying on the canalized Rhine was 85 meters (275.9 feet) long, 10.20 meters (33.5 feet) wide, with a maximum draft of 2.30 meters (7.55 feet) and maximum carrying capacity of 1,650 tons. The largest vessel which can be used on the not-canalized Main, from Offenbach to Würzburg, also to Kitzingen and Bamberg, under favorable water conditions, is about 83 meters (272.3 feet) long, 10 meters (32.80 feet) wide, with a carrying capacity of 600 tons.

(5) In general terms, canal barges built of steel or iron cost from 50 to 55 marks ($11.90 to $13.09) per ton carrying capacity; built of oak, 40 marks ($9.52); and of pine, 30 marks ($7.14).

Modern built paddle-wheel steamers cost from 250 to 350 marks ($59.50 to $83.30) per indicated horsepower and screw steamers from 200 to 260 marks ($47.60 to $61.88).

On the Elbe, Havel, and Spree the cost of paddle-wheel steamers ranges from 80,000 to 300,000 marks ($19,040 to $71,400) and screw steamers from 40,000 to 100,000 marks ($9,520 to $23,800).

On the Rhine, paddle-wheel steamers range in cost from 100,000 to 500,000 marks ($23,800 to $119,000) and screw steamers from 80,000 to 200,000 marks ($19,040 to $47,600).

Stern-wheel steamers on the canals cost from 100,000 to 200,000 marks ($23,800 to $47,600).

(6) Boats for carrying lumber and iron of long dimensions are constructed without bulkheads.

There are also iron tank barges of from 1,200 to 1,300 tons for carrying coal oil, which go to Magdeburg and Dresden and have special quays, where they are filled and emptied by means of pumps.

Some barges are specially fitted for carrying acids.

At the instance of the Bohemian and South German breweries, the Elbe shipping companies have had special barges built for the transportation of beer. These vessels are provided with ice machines and cold-storage rooms, by means of which the temperature can be regulated. The advantages thus provided over transportation by rail are the following: A quiet carriage without any shaking, such as is impossible on the railroads. An even temperature, which is necessary if the beer is to retain its excellence, and saving of freight.

Worthy of mention, further, are the barges which are used to transport fruit to Berlin from Bohemia. These are built of good wood in that country and are sent with a full cargo to Berlin, where their destiny is fulfilled, as they are then taken apart and the wood sold for building purposes. The amount thus realized covers at least the costs of material.[1]

The "Ziegel Transport A. G.," a German company for the transportation of bricks, operates barges built especially for the purpose, with electric motor power.

On the open rivers, as a general rule, the size of fleets of barges is unlimited; for instance, on the Elbe downward there are sometimes from 10 to 12 barges in one tow. In the canalized rivers and canals, however, the size and number of towed barges are limited by the police regulations governing the various canals and improved waterways. As example, the following are the regulations for tows of barges in the waterways under the supervision of the governor at Potsdam. The barges must not be over 5 meters (16.4 feet) apart.

(1) On the Havel: (*a*) On the Havel and in the Voss Canal from the Dammhaft bridge, in Zehdenick to the Finow Canal, 2 barges. (*b*) From the junction with the Spree, to and including Pichelsdorfer junctions, upstream 6 barges, downstream 3 barges. (*c*) From the Pichelsdorfer Junction to the Elbe, 6 barges, with the exception that in the canal in the city of Brandenburg only 4 barges are permitted in tows coming upstream and single barges in tows coming downstream.

(2) On the stretch between Sakrow and Paretz, 6 barges.

(3) On the Hohensaaten-Spandauer stretch: (*a*) From the Hohensaaten Locks up to and including Leipersee, 6 barges. (*b*) From Leipersee to the Pinnower Locks, 2 barges. (*c*) From Pinnower Lock to Spandau, 6 barges.

(4) On the Spree: (*a*) From Trebatch to Fluthkrug, 1 barge. (*b*) From and including Lake Dameritz to the upper limits of Berlin, 4 barges. (*c*) From the Charlottenburg railroad bridge to the Charlottenburg Locks, upstream, 3 barges; downstream, 2 barges. (*d*) From the Charlottenburg Locks to the junction with the Havel, upstream, 6 barges; downstream, 2 barges.

[1] Report of the American vice consul at Magdeburg, p. 90.

(5) On the Oder-Spree Canal and the stretches of the Friedrich Wilhelm Canal, which join the above canal, 4 barges, with the exception that in the canalized Spree, from Kersdorfer Locks to Grosse Traenke Lock, downstream, only 2 barges are permitted. On the stretches of the Friedrich Wilhelm Canal, which have not been widened, only 1 barge is permissible.

(6) On the Dahme, from the village of Bindoro to its junctions with the Spree, 4 barges.

(7) On the waterways of the Oranienburger Havel, Kuppiner Canal and the Rhin, from Zippelsforde to and including Lake Kremmin, 2 barges. On the Linumer Rhin and Fehrbellin Canal, 1 barge.

(8) On the old Oder from the Wriezen Dam Bridge to the Hohensaaten-Spandau Waterway, 2 barges.

(9) On Lake Beetz, 6 barges.

(10) On the Storkow Canal, 2 barges.

(8) Barges are constructed with the greatest possible bearing surface, so as to insure a large carrying capacity at low stages of the water in the canals and rivers, but the dimensions of the vessels are in many cases limited by the size of the locks in the canals. The barges are built as low as possible to enable them to pass under the bridges during high water. In many cases barges when loaded to their full capacity have a freeboard of only 6 or 8 inches.

### IV. OWNERSHIP OF VESSELS.

(*a*) With the exception of the government steamers, barges, dredging machines, ice breakers, etc., for keeping the channels in good condition, the vessels on the inland waterways of Germany are all privately owned and belong either to single individuals or to shipping corporations.

The tugs are in part owned by these individuals or companies, or chartered from special firms and societies. In the Elbe-Trave Canal, however, towing is carried on by the Free City of Lübeck, under a special tariff, and on the Teltow Canal the towage service is a monopoly of the county of Teltow, which owns the canal.

On the upper Main, the tugs for sunken chain towage are owned by the State of Bavaria.

(*b*) It is the tendency in Germany at the present time to unite the ownership of fleets of barges and tugs in the hands of corporations and syndicates, so that on the larger waterways the smaller boat owners are subjected to severe competition.

For details regarding the principal companies and syndicates which operate and control the bulk of the traffic on the inland waterways on the Elbe, Spree, Havel, and Oder, I would refer to the reports of the consular officers at Hamburg and Magdeburg, which are submitted as annexes to this report.

The Rhine traffic, as on the other waterways of Germany, is carried on by corporations and by private individuals. The more important companies and shipping firms are the following:

Cöln-Düsseldorfer Dampfschifffahrts Gesellschaft, with 30 passenger steamers.
Rheinischer-Lloyd, with 23 freight steamers.
Rhein und See Schifffahrts-Gesellschaft, with 28 steamers and 49 barges.
Mannheimer Lagerhaus Gesellschaft, with 15 steamers and 38 barges.
Mannheimer Dampfschleppschiff Ges., with 13 steamers and 71 barges.
"Badische Aktien Gesellschaft für Rheinschiffahrt," with 12 steamers and 69 barges.

Math. Stinnes, with 22 steamers and 84 barges.
Franz Hamer & Co., with 14 steamers and 56 barges.
Rheinschifffahrt vorm. Fendel, with 23 steamers and 74 barges.
Frankfurter, A. C., für Rhein-Main Schifffahrt, with 4 steamers and 42 barges.

In addition to the above a number of small barge owners have formed an association for the protection of their interests and to enable them to compete with the larger companies.

(*c*) Merchant vessels are not owned by the State nor by private railroads. There are a few producing and distributing concerns, such as the German branch of the Standard Oil Company, the Saccharin Fabrik at Westerhausen, various associations of coal dealers, etc., which have their own barges, but the tonnage of vessels operated by these concerns is very small when compared with the total tonnage of the vessels engaged in the inland water traffic of Germany.

(*d*) There are no fleets of merchant vessels owned and operated by public authorities in Germany.

(*e*) As stated above, towage of vessels in the Elbe-Trave Canal is carried on by the Free City of Lübeck, and in the Teltow Canal by the canal authorities. As a general rule, however, the towage service is in the hands of powerful syndicates and corporations, but there are associations of individual barge owners which compete successfully against the larger companies.

For details regarding the different syndicates and associations, I would refer to the reports of consular officers submitted with this report.

## V. TERMINAL FACILITIES.

(*a*) In the waterway system of Germany there are terminals at the principal points for loading, unloading, and storing freight. The most important are those at Königsberg on the Pregel, Breslau and Kosel on the Oder, Hamburg on the Elbe, Berlin on the Spree-Havel, Magdeburg on the Elbe, Minden on the Weser, Duisburg-Ruhrort on the Rhine, Cologne on the Rhine, Frankfort on the Main, Mannheim on the Rhine, Dortmund on the Dortmund-Ems Canal.

The principal harbors of the German Rhine from Strassburg down are shown in the following statement:

*German Rhine ports.*

| Name. | Administration. | Loading space. | Cranes. | |
|---|---|---|---|---|
| | | | Number. | Capacity. |
| | | *Miles.* | | *Tons.* |
| Strassburg | Municipal | 5.8 | 31 | 4 |
| Kehl | State | 6.4 | 10 | 8 |
| Karlsruhe | Municipal | 2.8 | 15 | ..... |
| Rheinau | State | 7.5 | 24 | 8 |
| Mannheim | do | 12.1 | 109 | 30 |
| Ludwigshafen | do | 3.4 | 57 | 10 |
| Worms | Municipal | 2.4 | 7 | 5 |
| Gustavsburg | State | 1.7 | 27 | 12 |
| Mayence | Municipal | 4.0 | 16 | 5 |
| Bingen | do | .9 | 5 | 7 |
| Coblenz | State | .7 | 4 | 9 |
| Cologne | Municipal | 5.2 | 45 | 30 |
| Mülheim on the Rhine | do | .62 | 10 | 6 |
| Düsseldorf | do | 6.2 | 36 | 25 |
| Duisburg-Ruhrort | State | 12.7 | 84 | 30 |
| Emmerich | do | 1.9 | 10 | 5 |
| On the Main: | | | | |
| Frankfort | Municipal | 3.2 | 38 | 8 |
| Offenbach | do | .9 | 7 | 10 |

For terminal facilities for unloading, storing, and transferring goods brought by water, Berlin is far behind other cities of inferior importance. The best harbors are the Humboldt Hafen and the city-owned harbor Urban Hafen. A new harbor has been built near Spandau, one of the suburbs of Berlin, and the new harbor at Stralau is nearly finished. There are no striking physical features of these terminals.

On one of the harbors of the Teltow Canal there was recently opened a large warehouse which covers practically three-quarters of an acre. It has five floors available for storage purposes. It is constructed entirely of iron and concrete, and is in direct communication with the State Railways and canal, so that merchandise can be readily and cheaply transferred from one to the other. The power station belonging to the canal authorities furnishes the electricity for working the hoisting and unloading machinery and for the electric lighting.

On the free rivers, and more especially on the canalized rivers and canals, long lines of embankments are fitted out as wharves and supplied with loading, storing, and unloading appliances, and many of the more important places have railway connections, thus forming the means of transshipping from water to rail and vice versa. This accounts for the comparatively small number of special harbors on the extensive network of Mark waterways on which, for instance, in Berlin and the suburbs, the banks of the Spree and of the canals are lined with wharves.

The most important terminal harbor in Prussia is that at Duisburg-Ruhrort, on the Rhine. In this harbor there are modern facilities for loading and unloading the boats; also for conveying the merchandise to and from the freight cars of the railway system. For a description of this and the other important ports I would refer to the report of the American Consul at Barmen and to those of the consular officers in whose districts the ports are located.

(*b*) The utility of the waterways has been greatly increased and the cost of transport by water diminished by shortening as much as possible the time necessary for loading and unloading the boats. Some of the new harbors—for instance at Duisburg-Ruhrort, Mannheim, Magdeburg, Kosel, and others—have been equipped with very complete arrangements for this purpose, consisting of coal chutes and tipplers, hydraulic, steam, and electric cranes, depots served by elevated lines of rails, fixed and movable grain elevators, granaries and sheds, and all arrangements for handling goods in bulk in the most rapid and cheap manner possible. For details regarding these facilities, I would refer to the reports of the consular officers submitted with this report.

(*c*) In the modern inland harbors of Germany railroad tracks are located in the terminals, permitting direct transfer between railroad and water lines, and the older harbors are being improved as far as possible to enjoy the same advantages. As stated above, in Berlin, although there is a belt railroad, the railway connection between the rail and water lines is defective. But few of the waterways of the city with the harbors and terminals are connected with the State Railway System.

In the Report on the Waterways of Germany, by W. H. Lindley, Volume VI of the Report of the Royal Commission on Canals and

Waterways, on pages 192 to 196 there is a table (G–7) in which is given interesting data regarding the inland harbors of Germany on the more important and on some branch waterways. A summary of the table given on page 67 of the report shows that of the inland harbors described 122 were connected with the railways and 191 were without railway connection.

(*d*) Mr. Lindley's report contains a vast amount of valuable and useful information regarding the waterways of Germany which will be of great interest to a student of the question.

The inland harbors of Germany, whether belonging to the State, to the municipalities, or to other corporations, are mostly public harbors; that is, anyone can use them. The terminals are not owned at all by private railways.

### VI. TOLLS AND FREIGHT RATES.

(*a*) Tolls are collected on canals and on certain improved rivers, for instance, the Oder from Kosel to Breslau, on the improved Saale, on the lower Weser from Bremen to Bremerhaven, on the Oder from Stettin to Swinemünde, and on the canalized Main from Gustavsburg to Frankfort.

At present there is a bill in the Prussian Parliament for the imposition of navigation dues, which has raised a storm of protest throughout the country. The question of levying tolls on navigable rivers in Germany dates back for several years, since Prussia launched her project of the general improvement of her waterways. To meet the heavy expenses necessary to carry out the policy, it is proposed to raise the required amount by the imposition of navigation dues. To do this there are two kinds of obstacles to overcome—constitutional and natural. According to article 54, section 4, of the imperial constitution, upon all natural waterways tolls may only be levied for the use of special accommodations, such as cranes, harbor facilities, docks, etc., that are made in the interest of traffic. Those dues, as well as those for the use of the state-owned canalized rivers and canals, may not exceed the amount necessary for covering the costs of construction, their maintenance, and working expenses, and may not be levied for the purposes of revenue. Therefore to pass a bill to levy tolls on the natural rivers makes it necessary to change the constitution. Prussia and Bavaria are in favor of the measure, as both are mutually interested in improvement of the Rhine and Danube, but Hesse-Darmstadt, Saxony, and Baden are strongly opposed.

Finally, but reluctantly, the Governments of the three latter States have consented to the principle set forth in the bill. The details of the measure are not known, only with the exception of one point, that Prussia and Bavaria have agreed to apply a sliding scale of tolls, so that the heavier burden is placed on the larger States. In what shape the bill will finally leave the Reichstag is very difficult to predict.

As to the international side of the question it will be necessary for the Imperial Government to enter into diplomatic negotiations with Austria, France, and the Netherlands. In a series of international treaties, dating from the Vienna congress of 1815 to the Berlin treaty of 1878, the several German States in question, which form a part

of the German Empire, and the three powers just mentioned have adopted the same principle which is contained in the German constitution. Austria, France, and the Netherlands must give their consent to the levying of tolls—Austria for the Danube and the Elbe, France for the Moselle, and the Netherlands for the Rhine. As far as France is concerned nothing is known of her position, but Austria already in no uncertain way has announced the strongest opposition and it is at least questionable whether or not she will agree. The Netherlands holds a similar position. Therefore it is clear that the carrying out of the new policy of levying tolls on natural waterways will be attended with much difficulty. It is said that the negotiations made necessary by the treaties mentioned above will not be entered into by the German Government before the bill for the change in the German constitution has passed Parliament.

Tolls are usually charged per ton and kilometer on loaded barges. On the Main, canalized from the Rhine to Frankfort, the tolls are levied on barges loaded with more than 200 tons of freight. Empty barges, barges loaded with less than 200 tons of freight, barges passing from the Rhine to the free uncanalized Main above Frankfort and vice versa, and goods that are transshipped on the canalized Main at Offenbach—that is, those which leave Offenbach Harbor on the waterway or on the railway—are free.

On the Dortmund-Ems Canal the dues are levied on loaded barges per ton-kilometer, but for empty barges with tugs there is a reduced rate. Tugs towing boats are free.

On the Mark waterways both empty boats and tugs without boats are subjected to reduced tolls. The same conditions prevail in the Elbe-Trave Canal. On the Teltow Canal in the local traffic goods received pay double the tolls of goods dispatched.

(*b*) The rates for towing, with the exception of the State-owned canals and the Teltow Canal, are established by the navigation companies, those for the Rhine by the shippers exchange at Duisburg, and depend upon the number of barges to be towed, upon the condition of the water, whether up or down stream, upon the distance, etc. The towing charges on the Rhine are influenced by the fact that the goods are carried up in fleets of large boats and that the strong current in the stretch between Ruhrort and Mannheim requires powerful tugs. The towing charges by steam tugboats are affected in those waterways where towing by horses is possible by the competition met with in the animal traction. With the above-mentioned exceptions there are no special tariffs, as the rates frequently change from day to day.

Under ordinary conditions of business and with the river (Elbe) at a normal height it costs $214.20 to tow a barge carrying 20,000 centners (2,200,000 pounds) from Hamburg to Madgeburg, a distance of 186 miles, or 0.952 to 1.1 cents per 110 pounds, but unfavorable conditions often double this rate. The navigation companies tow their own empty barges down the river in order to use them again as soon as possible, whereas under ordinary conditions they are allowed to drift with the current.[1]

For the towing rates on the Main, which are charged separately for vessels and cargo, I would refer to the report from the American

[1] Report from American consulate at Magdeburg, p. 94.

consulate general at Munich; for other towing charges I would refer to the reports of the consular officers submitted as annexes to this report.

One of the provisions of the law of April 1, 1905, for the improvement of Prussian waterways provides for a uniform State monopoly for towage on the canal from the Rhine to the Weser, the branch to Hannover, on the Lippe, and on the branch canals of these waterways; to forbid mechanical towage to others than the State using these canals and that boats traveling under their own power should need special permission.

(*c*) Generally speaking, there are no fixed rates for water transportation, as they vary from day to day, depending upon the size of shipment, the state of water in the canals and rivers, and upon the activity of trade.

Freight rates on the Elbe have fluctuated from 14 to 42 pfennigs ($0.033 to $0.099) within one month. Much depends, as respects that particular river, upon the demand for tonnage for return cargo, as the Elbe is a river upon which freight is carried both ways, while on the Rhine freight is chiefly carried in one direction. Thus it may happen that there is an excessive demand for tonnage for freight from Hamburg to the interior and an absence of cargo for the return trip. At other times precisely the opposite situation may exist, and at still other times the demands for tonnage in both directions may about balance. Offers for transportation are made upon the Hamburg Bourse every day, just as stocks and bonds and merchandise are offered for sale; and while the existence of large combinations of freight carriers tends to steady rates, the changes nevertheless are frequent and rapid.[1]

Lower than the prevailing rates may be obtained from private owners of barges (Wilde Schiffer) who are not in the syndicate, but the tonnage traffic of these boats is small compared with the total tonnage of the inland navigation of Germany.

The freight rates are usually calculated according to classes. On the Elbe the classification is as follows: First class: Coal, salt, ore, stone, and other heavy goods in bulk. Second class: Grain, oils, sugar, etc. Third class: Ordinary piece goods. Fourth class: Piece goods which require more careful handling, such as machines, etc.

(*d*) The rates increase slowly with the distance of the haul, but the increase is very moderate as long as the water is fairly high so that the vessels can travel with full cargoes, thus preventing a scarcity of barges. There are special steamers—Eilgutdampfer—for goods requiring speedy transportation. The fluctuation in freight rates is not so great on the canals and rivers east of the Elbe as far as the Oder. The following examples will illustrate these fluctuations: August 12, 1909, when the water was fairly low, the following rates were paid for freight, the barges being fully loaded:

| From Hamburg to— | | Cents. |
|---|---|---|
| Magdeburg (186 miles) | per 220 pounds | 4.2 to 4.5 |
| Schönebeck (195 miles) | do | 5.0 to 4.8 |
| Aken (214 miles) | do | 5.5 to 5.2 |
| Torgau (295 miles) | do | 6.9 |
| Dresden (357 miles) | do | 8.8 |
| Berlin (through the canal; 186 miles) | do | 6.6 to 6.1 |
| Halle (up the Saale; 258 miles) | do | 8.5 |

With similar conditions as regards the height of the river prevailing, but with greater quantity of goods to be transported on barges which, on account

[1] Report of consul general at Hamburg, p. 79.

of the comparatively low water, could not carry their full tonnage, the rates September 25, 1909, were as follows:

| From Hamburg to— | | Cents. |
|---|---|---|
| Magdeburg | per 220 pounds | 6.6 |
| Schönebeck | do | 7.1 |
| Aken | do | 7.3 |
| Torgau | do | 12.3 |
| Dresden | do | 13.5 |
| Berlin | do | 9.0 |
| Halle | do | 13.0 |

With less favorable water conditions the cargoes of the barges had to be considerably reduced, and a plentiful supply of goods to be shipped, the freight rates November 9, 1909, were as follows:

| From Hamburg to— | | Cents. |
|---|---|---|
| Magdeburg | per 200 pounds | 9.5 |
| Schönebeck | do | 10.0 |
| Aken | do | 10.2 |
| Torgau | do | 13.8 |
| Dresden | do | 17.1 |

From Magdeburg to Hamburg the barges are floated down the river, thus there are no charges for towing. The following rates prevailed during the last few months: August 12, 1909, 2.8 cents per 220 pounds; September 25, 1909, 3.1 cents per 220 pounds; November 6, 1909, 3.3 cents per 220 pounds. From Aussig to Magdeburg (248 miles), August 12, 2.8 cents; September 25, 2.8 cents; November 6, 3.4 cents. From Aussig to Hamburg (434 miles), August 12, 3.3 cents; September 25, 3.5 cents; November 6, 4.3 cents.

The above figures are for goods in bulk of Class I. For piece goods the fluctuations are not so great, the rate for fast freight from Magdeburg to Hamburg being between 14.3 and 16.6 cents per 220 pounds, and from Magdeburg to Lübeck 16.6 to 19 cents for the same quantity. The same rates apply from Hamburg and Lübeck to Magdeburg. It is further to be remarked that the figures given are the rates for carriage alone and do not include fees for transshipping, etc.[1]

(*e*) With the exception of shipments of grain up the Danube into Bavaria, and all classes of merchandise from Germany via Hamburg to the Levant and to the East Coast of Africa, no prorating arrangements exist between water lines and railroads. As regards the grain shipments mentioned above, the grain comes as far as Vienna or Passau by water on the vessels of the Erste K. K. Priv. Oesterreich. Donau Dampfschifffahrts-Gesellschaft, and then by the state railways to the various destinations. Copies of the joint rail and water tariff of this company are given in the report of the American consul at Nuremberg, which is submitted as an annex to this report.

The Deutsche Levante and the Deutsche-Ost-Afrika tariffs are well-known tariffs and they form a system of published through rates from the principal towns of Germany, through Hamburg, to the Levant by the steamers of the Deutsche Levante Line, and through Bremen by the Atlas Line, and to certain places in East Africa through Hamburg by the steamers of the Deutsche Ost-Afrika Linie. As to the varying proportions between ship and rail, these are not ascertainable, but in general the effect of the through rates is to institute competition with the Austrian rail rate through Trieste.

(*f*) In general the railroad freight rates to water competitive points are not higher than to interior nonwater points. It occurs occasionally that for economic reasons the freight rates are lowered, to give inland manufacturers an opportunity to ship their goods

[1] Report of vice consul at Magdeburg, p. 94.

by rail, when their plants are not located on a waterway, so as to compete with the goods of those manufacturers whose works have a water connection. This, for instance, was the main reason for granting an exceptional tariff on sugar for export in favor of refineries located at some distance from the rivers or canals. The basis of this rate is from 1 to 100 kilometers (0.62 to 62 miles), 2.6 pfennigs (0.619 cent) per ton-kilometer; over 100 kilometers, 2.2 pfennigs (0.524 cent) per ton-kilometer, with terminal charges of 60 pfennigs (14.28 cents) per ton, from 1 to 50 kilometers (0.62 to 31 miles), 90 pfennigs (21.42 cents) from 51 to and including 100 kilometers (31.7 to 62 miles); above 100 kilometers, 120 pfennigs (28.56 cents) per ton. The regular rate is 4.5 pfennigs (1.07 cents) per ton-kilometer, with the same terminal charges as above.

It is difficult to make a strict comparison between water rates and paralleling railroad rates, as there are no fixed rates for water transportation, as they vary from day to day, depending upon the size of the shipment, the state of water in the canals and rivers, and upon the activity of the trade. From the report of this consulate-general on "Transportation rates by rail and water in the consular district of Berlin," dated April 6, 1909, I give the following data: The railroad rates designated by *A* are the actual rates for goods intended for export. The water rates via regular steam barge companies designated *B*, and the water rates via private barges designated *C* are the same as given, whether the goods are for export or for consumption in Germany:

| | Under 5 tons. | Per ton per mile. | 5 to 10 tons. | Per ton per mile. | 10 tons and over. | Per ton per mile. | 50 tons. | Per ton per mile. |
|---|---|---|---|---|---|---|---|---|
| Cement: | | *Cents.* | | *Cents.* | | *Cents.* | | *Cents.* |
| A | $4.95 | 2.8 | $2.62 | 1.5 | $1.76 | 1.01 | ..... | ..... |
| B | 1.07 | .45 | .95 | .4 | .95 | .4 | ..... | ..... |
| C | ..... | ..... | ..... | ..... | ..... | ..... | $0.52–0.60 | 0.21–0.25 |
| Grain: | | | | | | | | |
| A | 4.95 | 2.8 | 3.62 | 2.07 | 1.97 | 1.13 | ..... | ..... |
| B | 1.43 | .6 | 1.31 | .55 | 1.19 | .5 | ..... | .3 |
| C | ..... | ..... | ..... | ..... | ..... | ..... | .60–.71 | .25– ... |
| Iron: | | | | | | | | |
| A | 4.95 | [1]2.8 | 2.14 | 1.23 | 1.07 | .61 | ..... | ..... |
| B | 1.43 | .6 | 1.43 | .6 | 1.19 | .5 | ..... | ..... |
| C | ..... | ..... | ..... | ..... | ..... | ..... | .60–.71 | .25–.3 |
| Flour: | | | | | | | | |
| A | 4.95 | 2.8 | 3.62 | 2.07 | 1.97 | 1.13 | ..... | ..... |
| B | 1.31 | .55 | 1.19 | .50 | 1.19 | .5 | ..... | ..... |
| C | ..... | ..... | ..... | ..... | ..... | ..... | .60–.71 | .25–.3 |
| Oil and fats: | | | | | | | | |
| A | 4.95 | 2.8 | 4.95 | 2.8 | 4.28 | 2.46 | ..... | ..... |
| B | 1.19 | .5 | 1.19 | .5 | 1.19 | .5 | ..... | ..... |
| C | ..... | ..... | ..... | ..... | ..... | ..... | .60–.71 | .25–.3 |
| Sand: | | | | | | | | |
| A | 4.95 | 2.8 | 2.62 | 1.5 | 1.64 | .94 | ..... | ..... |
| B | 1.19 | .5 | 1.19 | .5 | 1.19 | .5 | ..... | ..... |
| C | ..... | ..... | ..... | ..... | ..... | ..... | .52–.60 | .21–.25 |
| Coal: | | | | | | | | |
| A | 4.95 | 2.8 | 2.62 | 1.5 | 1.64 | .94 | ..... | ..... |
| B | 1.19 | .5 | 1.07 | .45 | .95 | .45 | ..... | ..... |
| C | ..... | ..... | ..... | ..... | ..... | ..... | .48–.60 | .2–.25 |
| Terra-cotta pipes, etc.: | | | | | | | | |
| A | 4.95 | 2.8 | 2.62 | 1.5 | 1.76 | 1.01 | ..... | ..... |
| B | 1.90 | .8 | 1.79 | .75 | 1.67 | .7 | ..... | ..... |
| C | ..... | ..... | ..... | ..... | ..... | ..... | .71–.95 | .3–.4 |

[a] These rates are for merchandise exported to countries outside of Europe; for goods exported to European countries the rates are for 5 to 10 tons lots $2.80, or per ton per mile 1.6 cents; for 10 tons lots and over $1.40, or per ton per mile 0.8 cents.

The following are the rates by rail and water between Berlin and Stettin:

[Distance by rail, 84 miles; distance by water, 117 miles.]

| | Under 5 tons. | Per ton per mile. | 5 to 10 tons. | Per ton per mile. | 10 tons and over. | Per ton per mile. | 50 tons. | Per ton per mile. |
|---|---|---|---|---|---|---|---|---|
| Cement: | | *Cents.* | | *Cents.* | | *Cents.* | | *Cents.* |
| A | $2.62 | 3.11 | $1.40 | 1.67 | $1.00 | 1.19 | | |
| B | 1.19 | 1.01 | .95 | .81 | .95 | .81 | | |
| C | | | | | | | $0.46–$0.57 | 0.41–0.49 |
| Grain: | | | | | | | | |
| A | 2.62 | 3.11 | 1.90 | 2.26 | 1.47 | 1.75 | | |
| B | 1.67 | 1.42 | 1.43 | 1.22 | 1.19 | 1.01 | | |
| C | | | | | | | .57– .67 | .49– .57 |
| Iron: | | | | | | | | |
| A | 2.62 | [1] 3.11 | [1] 1.19 | [1] 1.41 | [1] .595 | .71 | | |
| B | 1.43 | [1] 1.22 | [1] 1.19 | [1] 1.01 | [1] 1.07 | .91 | | |
| C | | | | | | | .52– .595 | .45– .51 |
| Flour: | | | | | | | | |
| A | 2.62 | 3.11 | 1.90 | 2.26 | 1.47 | 1.75 | | |
| B | 1.43 | 1.22 | 1.19 | 1.01 | 1.19 | 1.01 | | |
| C | | | | | | | .57– .67 | .49– .57 |
| Oils and fats: | | | | | | | | |
| A | 2.62 | 3.11 | 2.62 | 3.11 | 2.21 | 2.63 | | |
| B | 1.43 | 1.22 | 1.19 | 1.01 | 1.19 | 1.01 | | |
| C | | | | | | | .52– .595 | .45– .51 |
| Sand: | | | | | | | | |
| A | 2.62 | 3.11 | 1.40 | 1.67 | .86 | 1.05 | | |
| B | 1.43 | 1.22 | 1.07 | .91 | .95 | .81 | | |
| C | | | | | | | .48– .57 | .41– .49 |
| Coal: | | | | | | | | |
| A | 2.62 | 3.11 | 1.40 | 1.67 | .88 | 1.05 | | |
| B | 1.19 | 1.01 | .95 | .81 | .95 | .81 | | |
| C | | | | | | | .48– .57 | .41– .49 |
| Terra cotta: | | | | | | | | |
| A | 2.62 | 3.11 | 1.40 | 1.67 | 1.00 | 1.19 | | |
| B | 1.67 | 1.42 | 1.31 | 1.12 | 1.07 | .91 | | |
| C | | | | | | | .595– .76 | .51– .65 |

[a] These rates are for merchandise exported to countries outside of Europe; for goods intended for European countries the rates are for 5 to 10 tons lots $1.67, or per ton per mile 1.98 cents; for lots of 10 tons and over $0.83, or per ton per mile 0.99 cents.

According to Peters "Schiffahrts Abgabon," volume 115, Schriften des Vereins für Sozialpolitik, page 165 et seq., the average water freight per ton for grain from Hamburg to Berlin from 1900 to 1905 was $0.65, or .36 cent per ton per mile, and the average railroad rate $3, or 1.7 cents per ton per mile.

The same authority states that the average rates per ton for sugar from Breslau to Hamburg, passing through Berlin, were as follows from 1897 to 1906: Export sugar, $3.47, or .916 cent per ton per mile; rail, home consumption, $6.81, or 1.8 cents per ton per mile; water, home consumption, $1.35, or .27 cent per ton per mile. Distance by rail, 610 kilometers (379 miles); distance by water, 799 kilometers (496 miles).

While there is active competition between the German railroads and waterways the relations are friendly. The exceptional railroad tariffs fully described in Chapter I of this report for goods intended for export were made not only to foster the German industries, but to meet the competition of the waterways leading out of the Empire or of alternative waterway routes through other countries or States.

Some four or five years ago the water was so low in the Oder that the coal-laden barges could not come from Posen to Berlin with their cargoes. The vessels were for months stranded in the river

without being able to proceed. The Prussian minister of public works, the head of the railway administration, issued instructions permitting the coal to be hauled to the nearest railway station and shipped by rail to Berlin at specially cheap rates of freight.

During the close of the regular water traffic between Stettin and Swinemünde on account of ice special reduced rates of freight are granted to shipments by rail. The distance is calculated at 80 kilometers (49.7 miles), instead of the actual distance, 112 kilometers (69.6 miles).

The difference between the special and the regular rates, for instance, for express goods is as follows: Regular rate, 2.74 marks (65.2 cents) per 100 kilograms (220.46 pounds); special rate, 2.10 marks (50 cents); for piece goods, regular rate, 1.37 marks (32.6 cents); special rate, 1.05 marks (25 cents).

For goods of Special Tariff II in carload lots of at least 10 tons: Regular rate, 0.51 marks (12.1 cents); special rate, 0.37 marks (8.8 cents). Goods included in Special Tariff II are railway locomotives and tenders, flax, hemp, certain kinds of wood, jute, stone, etc.

It may be stated that the exceptional rates of the Prussian railways for agricultural and other products are so low that when the river conditions are unfavorable they are no higher than the rates for water transportation, and in some cases even less.

Prussia is expending vast sums annually in improving and developing her waterways and thus virtually helping the competitors of her railway systems. The policy, however, is a farsighted one, as land is reclaimed by drainage, fields are protected against floods and rendered fertile by irrigation, enhancing their taxable value, and thus increasing the revenues from taxation. The industries are encouraged by enabling industrial plants to be erected on what otherwise would be unavailable sites, with cheap water transport for raw materials and good rail connection for the distribution of the finished products, thus increasing the traffic on the railways. The welfare of the people as a whole is fostered and the vitality of the nation improved.

There is no legislation regulating the relations between rail and inland waterway systems of transportation; neither is there any governmental restriction on the lowering of freight rates in competition with water rates.

With the exception of merchandise of low value, goods when shipped on the waterways are usually insured by the consignor or by the navigation company when requested. Large firms which ship regularly by water have open policies issued by the various insurance companies. The average rate of insurance is 1 mark ($0.238) per 1,000 marks ($238).

The insurance does not affect the freight rates.

## VII. WATER-BORNE TRAFFIC.

The bulk of the water-borne traffic of Germany consists of coal, ores, agricultural products, and wood. Berlin is the center and mart of a labyrinth of canals and canalized watercourses. The following statement of the water traffic of this city and Charlottenburg for

the past three years will indicate the general character of the commodities carried:

*Water traffic in Berlin and Charlottenburg for the past three years, in metric tons.*

[Not including goods in transit.]

| Description. | Imports. | | | Exports. | | |
|---|---|---|---|---|---|---|
| | 1906. | 1907. | 1908. | 1906. | 1907. | 1908. |
| Bricks, cement, lime, sand, stone, etc. | 6,502,796 | 4,617,286 | 4,003,850 | 208,040 | 303,628 | 294,314 |
| Wood | 439,133 | 343,120 | 311,589 | 20,931 | 14,455 | 11,107 |
| Coal | 1,452,576 | 1,522,975 | 1,616,629 | 36,958 | 19,984 | 18,283 |
| Raw material | 407,569 | 325,708 | 307,841 | 120,330 | 83,363 | 91,751 |
| Finished material | 12,342 | 12,626 | 10,495 | 15,873 | 16,528 | 15,675 |
| Food products | 735,977 | 698,749 | 649,251 | 102,800 | 83,998 | 105,782 |
| Live cattle | 99,782 | 98,772 | 107,630 | 240,907 | 237,018 | 164,152 |
| Total | 9,650,175 | 7,619,236 | 7,007,285 | 745,839 | 758,974 | 701,164 |

In Mr. Lindley's report on the German waterways, on page 206, an interesting statement of the "Classification of traffic on some of the more important lines of waterways for the year 1905" is given. The proportion in which the various classes of goods are represented at important points of the principal waterways in the transit, upstream or downstream traffic, and in the goods received or dispatched, based on the statistics of 1905, is shown.

According to the said report, of the total traffic at Ruhrort-Duisburg, 13,640,000 tons, about 30 per cent are received and 70 per cent dispatched. Of the goods received, 4,200,000 tons, 60 per cent are ores, pig iron, and scrap, and 19.7 per cent agricultural produce.

Of the traffic dispatched from Ruhrort-Duisburg, 9,450,000, a total of 8,840,000, or 93.6 per cent, are coal, coke, etc. Of this about 60 per cent go upstream and 40 per cent downstream.

In Hamburg, on the Elbe, of the total transit traffic, 5,920,000 tons, 58 per cent are upstream and 42 per cent downstream. Of the traffic upstream, 40.1 per cent are agricultural products, and of the downstream traffic 29.9 per cent is sugar and 24.8 per cent manure.

Of the water-borne traffic at Berlin and Charlottenburg in 1905, 10,110,000 tons, 93 per cent are goods received and only 7 per cent goods dispatched.

Of the goods received, 6,300,000 tons, or 66.8 per cent, consist of building materials; 1,430,000 tons, or 15.1 per cent, of coal, coke, etc.

Coal and ores are preponderant in the western basins, specially on the Rhine. Wood and agricultural produce form the chief articles of transport in the east, the Oder having at the same time a considerable transport of coal.

Besides this, special articles of produce, sugar, and salt form a large contingent in their respective basins—for instance, on the Elbe. In the neighborhood of larger towns, building materials, sand, gravel, stone, bricks, etc., are transported by water in large quantities; as, for instance, on the Mark waterways at Berlin, on the Rhine at Cologne, on the Main at Frankfort, and on the Weser at Bremen.

Besides the above information, taken from Mr. Lindley's report, more detailed data regarding the principal commodities moved, the proportion and character of traffic moved in different directions, are given on pages 78 to 81.

While there are no statistics available showing the relative importance of package and bulk freight, the former is a very small percentage of the water-borne traffic.

Besides the statistics of vessel movement and traffic carried on inland waterways and railroad traffic, tonnage, and ton mileage, furnished in the reports of other consular officers, submitted as annexes to this report, attention is called to the Statistical Year Book of the German Empire for 1909.

Taking important inland water routes, the through traffic predominates, but in what general proportion it would be difficult to estimate.

In a table, given on page 76 of Mr. Lindley's report, showing the summary of the total traffic on the inland waterways of Germany, exclusive of the estuaries navigated by seagoing vessels, set forth in great detail in Table G—12, page 200, the mean distance traveled by 1 ton of freight in 1875 was 132 miles; in 1895, 155 miles; in 1900, 153 miles, and in 1905, 139 miles. The increase in length of travel from 1875 to 1895 was due to the great development of long-distance transport, the decrease from 1895 to 1905, to an increase in the short distance and local traffic.

According to the latest schedule, the wages paid to labor employed on the waterways are as follows per month:

| | Marks. |
|---|---|
| Captains of steamers | 160=$38.05 |
| Mates of steamers | 135= 32.13 |
| Engineers of steamers | 140= 33.32 |
| Firemen of steamers | 105= 24.99 |
| Helmsmen of barges | 135= 32.13 |
| Boatmen on barges | 105= 24.99 |

No mileage is paid. The wages include lodging, but not board. During the winter, when the boats are laid up, the wages of the captains and engineers of steamers are reduced 1 mark ($0.238) per day; the other employees are discharged.

The captains and engineers also receive 1 per cent of the fees, such as towage fees, etc., paid, which amounts to from 50 to 100 marks ($11.90 to $23.80) per year.

The hours of labor are from 6 a. m. to 6 p. m. Overtime is paid at the rate of 50 pfennigs (11.9 cents) per hour up to 10 p. m. After that time 60 pfennigs (14.28 cents) per hour, for all the people employed.

The above tariff, by the terms of which all wages were increased, was the result of an agreement entered into by the navigation companies and private owners of steamers and barges and the workmen's unions. It went into effect in October last, and applies to the navigation on the Elbe, Oder, Spree, and Havel.

The existing laws regarding insurance against sickness, accident, old age, and invalidity cover all persons employed on the waterways.

## SUPPLEMENTARY REPORTS.

1. Rivers and canals in the consular district of Hamburg. Report by Robert P. Skinner, consul-general, page 69.

2. Rivers and canals in the consular district of Magdeburg. Report by James L. A. Burrell, vice-consul, page 85.

3. Rivers and canals in the consular district of Bremen. Report by William Thomas Fee, consul, page 97.

4. Rivers and canals in the consular district of Barmen, with descriptions of the Dortmund-Ems Canal and the inland harbors of Dortmund, Duisburg-Ruhrort, Neuss, and Düsseldorf. Report by George Eugene Eager, consul, page 103.

5. Rivers and canals in the consular district of Cologne. Report by H. J. Dunlap, consul, page 125.

6. Inland waterways and canals in the consular district of Breslau. Report by Herman L. Spahr, consul, page 131.

7. Rivers and canals of the upper Rhine district. Report by William J. C. Teichmann, consul, page 139.

8. Rivers and canals in Baden. Report by Ernest L. Ives, vice-consul at Mannheim, page 151.

9. Rivers and canals of the upper Rhine district. Report by William J. Pike, consul at Kehl, Baden, page 157.

10. Railway rates, inland waterways and canals of Bavaria. Report by Thomas Willing Peters, consul-general at Munich, page 163.

11. Bavarian waterways and canals. Report by George Nicolas Ifft, consul at Nuremberg, page 175.

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These reports are in the main replies to the questions found on pages 3 and 4.

# RIVERS AND CANALS IN THE CONSULAR DISTRICT OF HAMBURG.

Report by ROBERT P. SKINNER, *Consul General.*

## I. PUBLIC SUPERVISION.

I. (a) The various State authorities exercise supervision over the Elbe where it passes through their respective territories. In Prussia the chief president of the Province of Saxony is also the chief of the Elbstrombauverwaltung, and he has authority over river navigation within that Kingdom. In the Duchy of Anhalt this supervision is exercised by the department of the interior; in the Kingdom of Saxony the Amtshauptmannschaften of Pirna and Dresden-Neustadt act as Stromamt. In the State of Hamburg the department of commerce and navigation is in control, although the buildings and improvements on the banks of the river are in charge of the building department. There are, moreover, various local regulations which apply where the river flows through cities, but these are more properly local police regulations prescribed because of the particular circumstances.

The State of Lübeck built the entire Elbe-Trave Canal at its own expense, although this canal traverses other territory, and the State of Lübeck supervises navigation over the same.

(b 1) The various authorities mentioned in the preceding paragraph are public functionaries and have no powers or duties in respect to the capitalization of navigation companies or the regulation of their rates. It is their duty to maintain and improve the channel and to provide regulations for the ordinary and orderly dispatch of business and for the general security and interest of the public. Neither do these authorities have anything to do with the maintenance and improvement of terminal facilities, which, in most instances, are private property, being generally owned and operated by private shipping companies, and, in a few instances, occupying municipal property which is leased to the shipping company.

(b 2) Statistics relating to German river navigation are collected in part by the Imperial statistical bureau and in part by the various State offices. Some navigation companies collect private statistics for their own use.

II. (*a*) There is no established policy as to water power developed by works constructed for the improvement of navigation on the Elbe.

(*b*) River improvements and the building of canals are carried on by State governments and not by private associations. As mentioned before, the Elbe-Trave Canal, which merely terminates at Lübeck and does not traverse the territory of that State, was built at that State's expense.

(*c*) There are no elaborate terminal facilities in Hamburg, as traffic conditions apparently do not require their existence. The river-borne traffic between Hamburg and inland points is in reality nothing less than an extended lighterage service, the river barges unloading and receiving their cargoes, as a rule, directly alongside the ocean-going steamers and sailing vessels. It is precisely because of the facilities for exchanging their cargoes in this manner that river traffic from and to Hamburg has attained such immense proportions.

III. Answers to questions appearing under III. "Floating equipment," will be found in the next following pages.

### STATISTICS OF VESSELS ON GERMAN WATERWAYS.

According to the "Regulations regarding statistics of the fleets of German river and canal ships," approved by the Federal Council in December, 1907, such statistics are required to be made every five years (at the end of every fifth year), and they must comprise all freight and passenger ships used for business purposes (namely, all without motive power of 10 and more tons' capacity, and all business vessels with motive power).

Besides the river and canal craft proper, such vessels must be included in the statistics as are engaged at the mouths of rivers and canals and on bays, as well as on lakes in the interior, and which are not included in the statistics of seagoing vessels, particularly also such seagoing vessels by which the transfer from river and canal navigation to deep-sea navigation is effected (for instance the seagoing Rhine steamers, seagoing lighters, and similar craft). The statistics must be made at the respective home ports of the ships.

The first statistics were collected under these regulations on December 31, 1907, and the result thereof was published in the "Statistics of the German Empire," fourth quarter, 1908.

Accordingly, the following number of ships was counted:

| Steamships. | Passenger ships. | | | Total, including tugs and motor boats. | | |
|---|---|---|---|---|---|---|
| | Number. | Capacity. | Horse-power. | Number. | Capacity. | Horse-power. |
| | | *Tons.* | | | *Tons.* | |
| Coast waters of the Baltic, east of the Vistula | 25 | 1,182 | 2,303 | 117 | 6,422 | 11,15 |
| Waters of the Vistula | 40 | 1,099 | 3,788 | 82 | 4,168 | 8,673 |
| Coast waters of the Baltic, between Vistula and Oder | 1 | 8 | 8 | 4 | 17 | 4 |
| Waters of the Oder | 52 | 2,416 | 5,384 | 391 | 21,149 | 53,75 |
| Coast waters of the Baltic, west of the Oder | 41 | 1,003 | 2,276 | 149 | 2,532 | 5,04 |
| Coast waters of the North Sea, Schleswig Holstein | 4 | 99 | 248 | 8 | 129 | 27 |
| Waters of the Elbe | 402 | 13,792 | 37,400 | 1,771 | 75,985 | 176,48 |
| Waters of the Weser | 18 | 1,045 | 1,802 | 91 | 8,012 | 13,45 |
| Waters of the Ems | 10 | 255 | 431 | 58 | 4,776 | 5,61 |
| Waters of the Rhine | 94 | 8,188 | 26,297 | 567 | 56,489 | 187,82 |
| Lake of Constance | 20 | 817 | 2,930 | 46 | 2,339 | 4,00 |
| Waters of the Danube | 1 | 45 | 42 | 12 | 1,731 | 4,91 |
| Lakes of Upper Bavaria | 11 | 392 | 2,130 | 15 | 399 | 2,18 |
| Total | 719 | 30,341 | 85,039 | 3,311 | 184,148 | 473,41 |

Of these 3,311 ships there were in all 240 wooden vessels (only 7 on the waters of the Rhine). The largest draft of these vessels was 3.85 meters (12.32 feet) on the Elbe, and 2.77 meters (9.09 feet) on the Rhine; however, the steamers plying on the Rhine had in general the largest dimensions, the maximum dimensions of a vessel being 88.85 meters (281.65 feet) length, 20.7 meters (67.91 feet) beam, and 10 meters (32.8 feet) height. The steamers on the Elbe had the next largest dimensions.

| Ships without motive power. | Number. | Capacity. |
|---|---|---|
| | | *Tons.* |
| Coast waters of Baltic east of Vistula | 819 | 112,389 |
| Waters of the Vistula | 496 | 79,047 |
| Coast waters of Baltic, between Vistula and Oder | | |
| Waters of the Oder | 4,051 | 993,565 |
| Coast waters of Baltic, west of Oder | 477 | 33,541 |
| Coast waters of North Sea, Schleswig-Holstein | 5 | 188 |
| Waters of the Elbe | 12,005 | 2,340,985 |
| Waters of the Weser | 474 | 151,599 |
| Coast waters between Weser and Ems | 33 | 992 |
| Waters of the Ems | 960 | 98,554 |
| Waters of the Rhine | 3,477 | 2,115,465 |
| Lake of Constance | 17 | 2,845 |
| Waters of the Danube | 107 | 58,918 |
| Lakes of upper Bavaria | 2 | 23 |
| Total | 22,923 | 5,988,111 |

Of these ships 14,290 were built of wood; the remaining 8,633 of iron or other metal. While on all other rivers and canals of eastern Germany, wood is extensively used as building material for river craft, there were only 1,150 wooden ships among the 3,477 Rhine vessels, or approximately one-third. The largest draft, 5.8 meters (19.03 feet), is found among the first group (coast waters of the Baltic, east of the Vistula); the greatest length and height, 102.6 and 9.8 meters (336.62 and 32.15 feet), respectively, is represented among the ships plying on the Rhine, while a vessel employed on the Elbe has the greatest beam, 13.8 meters (45.27 feet). Among the Rhine ships the greatest beam is 12.08 meters (39.63 feet).

Consequently, according to the foregoing figures the fleet of German inland waterway ships consisted of 26,234 vessels, aggregating a carrying capacity of 6,172,259 tons. Thereof 14,530 were wooden vessels and 11,704 vessels built of iron or other metal. The largest number of ships and greatest tonnage are employed on the Elbe waters, namely, 13,776 ships of 2,416,970 tons, the Rhine holding the second rank, there plying 4,044 vessels of 2,171,954 tons on this river and adjacent waters. Then follow the Oder waters (4,442 ships of 1,014,714 tons), Weser waters (565 ships of 159,611 tons), coast waters of the Baltic, east of the Vistula (936 ships of 118,811 tons), Ems waters (1,118 ships of 103,330 tons), Vistula waters (578 ships of 83,215 tons), Danube waters (119 ships of 60,649 tons), etc. Notwithstanding the enormous traffic in Hamburg, which is the home port of 6,733 vessels plying on inland waterways, the fleet on the Elbe waters is only a little ahead of that employed on the Rhine, the difference in tonnage being 245,016 tons.

The following statistical table also gives an interesting picture of the fleet of German river and canal vessels, particularly in regard to their relative size or tonnage:

*Fleet of German River and canal vessels on December 31, 1907.*

| | Number of ships. | Number of ships the tonnage of which has been ascertained. | Tonnage. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Total. | Number of vessels the tonnage of which was— | | | | | | | |
| | | | | Below 50 tons. | 50–100 | 100–150 | 150–250 | 250–400 | 400–600 | 600–800 | 800 tons and more. |
| Total | 26,235 | 26,191 | 5,913,020 | 7,393 | 3,537 | 1,859 | 6,301 | 3,122 | 1,867 | 899 | 1,213 |
| Ships without motive power | 22,923 | 22,899 | 5,725,258 | 5,095 | 3,102 | 1,658 | 6,060 | 3,037 | 1,853 | 888 | 1,206 |
| Ships with motive power | 3,312 | 3,292 | 188,762 | 2,298 | 435 | 201 | 241 | 85 | 14 | 11 | 7 |
| Passenger ships (including launches and motor boats) | 1,067 | 1,067 | 33,476 | 862 | 164 | 13 | 19 | 9 | ..... | ..... | ..... |
| Freight ships | 642 | 641 | 70,580 | 345 | 51 | 63 | 107 | 45 | 14 | 9 | 7 |
| Tugs | 1,558 | 1,539 | 81,654 | 1,071 | 203 | 125 | 107 | 31 | ..... | 2 | ..... |
| Chain steamers | 45 | 45 | 3,052 | 20 | 19 | ..... | 8 | ..... | ..... | ..... | ..... |

Vessels on the Elbe carry up to 1,500 tons burden, and have a draft of 1.90 meters (6.233 feet) when fully laden. Modern barges and canal boats are made of iron and steel chiefly. The Vereinigte Elbschiffahrts Gesellschaft, A. G., states that the average cost of a 1,000-ton steel barge is 50,000 marks ($11,900), and an oak-wood barge 40,000 marks ($9,520). However, the wooden barges are rapidly becoming obsolete.

Special types of barges are in use for the transportation of lumber and iron of large dimensions, for which vessels without bulkheads are employed and in which an undivided hold is available.

All vessels used on the Elbe and tributaries are adapted to medium stages, being always built with broad flat bottoms.

### IV. OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

While there is free competition on the Elbe, and of such an active nature that the section of the Hamburg bourse occupied by vessel owners is quite important, it is also true that a number of large corporations have forged to the front, maintaining organized services and exercising a power of control over rates and conditions.

The Vereinigte Elbschiffahrts-Gesellschaften, A. G., Dresden and Hamburg, maintains an Elbe-going service by means of 71 side-wheel steamers, 24 chain steamers, and 34 harbor steamers; on the Saale the same company has 5 chain steamers; on the Oder 4 side and stern wheel steamers. The same company owns 29 warehouses and pontoon ships, 419 freight steamers, and 235 small lighters. The chain steamers referred to are propelled by means of a cogwheel, the teeth of which fit into a towing chain laid in the river bottom, on the principle of the cog and pinion mountain railways. The length of the towing chain on the Elbe from Niegripp to Melink is 458 kilometers (285 miles) and on the Saale from Barby to Halle 107 kilometers (66 miles). The indicated horsepower of the above-mentioned 71

side-wheel towing steamers varies between 250 and 1,200; they are from 50 to 72 meters (164 to 263 feet) long, 5.2 to 9 meters (17 to 29 feet) wide, or 10.36 to 18.7 (33 to 61 feet) over the paddle box, and their crews consist of from 8 to 12 men. The company's fleet includes 19 express freight steamers of from 170 to 350 indicated horsepower, and are from 55 to 65 meters (180 to 213 feet) in length and 5.5 to 7 meters (18 to 22 feet) wide, or 11.6 to 12.8 meters (38 to 42 feet) wide over the paddle box. These express steamers have crews of 8 men. The company's 30 chain steamers on the Elbe and Saale have 66, 90, 120, and up to 180 indicated horsepower, vary in length from 32 to 55 meters (104 to 180 feet), in width from 5.5 to 8.2 meters (18 to 26 feet), and have crews of 7 men. Screw steamers to the number of about 39 have from 40 to 250 indicated horsepower, are from 12 to 25 meters (39 to 82 feet) in length, 3.2 to 5.2 meters (10 to 17 feet) broad, and have crews of 3 and 4 men. This company possesses a steam dredge, 7 steam launches, 9 motor boats, 2 repair ships, 4 floating steam derricks, 19 floating steam winches, 5 small barges with winches, 9 stationary derricks, 2 electric derricks, and 1 derrick for the removal of masts. In addition to its own fleet, this company operates about 700 vessels on regular time charters, and either owns or leases warehouses in Dresden, Magdeburg and Hamburg.

The Neue Deutsche Böhmische Elbe-schiffahrt, A. G., was established in Dresden in 1907, and owns a fleet of 14 side-wheel towboats of from 500 to 1,225 indicated horsepower, 4 harbor steamers of from 250 to 375 horsepower, 50 iron freight barges of from 500 to 850 tons carrying capacity, 7 wooden freight barges of from 400 to 650 tons, about 70 chartered freight barges of from 500 to 1,200 tons, and a few small craft.

The Neue Norddeutsche Fluss-Dampfschiffahrts-Gesellschaft, of Hamburg, maintains a freight and towing service between Hamburg, Magdeburg, Schönebeck, Aken, Wallwitzhafen, Torgau, and Berlin. It has at its disposition 8 side-wheel steamers of from 180 to 900 indicated horsepower, 1 twin-screw steamer of 280 horsepower, 4 harbor tugs of from 90 to 300 horsepower, 65 iron freight barges aggregating 37,100 tons, 4 barges serving for warehousing purposes, and a number of small auxiliary vessels and derricks.

Fr. Andreae, G. m. b. H., of Magdeburg, maintains a regular freight service on the Elbe between Magdeburg and Hamburg, a regular express service from Magdeburg to Berlin, Mecklenburg, and Silesia, and vice versa, and from Magdeburg to Stettin, other places in Pomerania and the Baltic provinces. The corporation operates 5 freight steamers, 16 iron barges for the Elbe service, of from 500 to 1,500 tons, for canal traffic 14 iron and 2 wooden barges, and a number of smaller vessels stationary in the harbors of Stettin and Magdeburg. The firm further owns a terminus of its own in Magdeburg, with steam and gas derricks and warehouses.

The Berliner Lloyd, A. G., with its seat in Berlin, maintains a regular freight-towing service and daily express service between Hamburg and Berlin, a triweekly express service between Hamburg and Breslau, between Magdeburg and Landsberg on the Warthe, and Oder stations, as well as between Goyatz, Oder stations, and Hamburg. The company owns 23 express freight steamers of from 150 to

300 horsepower and from 250 to 700 tons capacity, 2 motor barges of 100 horsepower and 500 tons burden each, 5 tugs of from 150 to 300 horsepower and 2,000 to 3,000 towing capacity each, and 5 smaller towing steamers of from 80 to 200 horsepower. 60 first-class freight barges, aggregating 50,000 tons carrying capacity, a steam derrick in Berlin, and a complete service in Hamburg for the handling of freight in the port, the fleet for this purpose consisting of 80 iron harbor barges.

Lueders & Stange, of Hamburg and Lübeck, maintain a regular freight and express service from Lübeck to Hamburg, Lauenburg, Magdeburg, Berlin, and other stations on these routes. The express service between Hamburg is maintained by 2 steamers, besides the firm operates 12 of its own and a number of chartered barges; it possesses a modern terminus in Lübeck, with three spacious warehouses.

Behucke & Mewes, of Hamburg, maintain a freight and towing service between Hamburg and Magdeburg, Schönebeck, Aken, Wallwitzhafen, Torgau, Riesa, Meissen, Dresden, Laube, Tetschen, Schonpriesen, Aussig, and Berlin. The company owns 8 towing steamers of from 200 to 800 indicated horsepower, and besides, regularly employs a number of chartered steamships.

The Privatschiffer Transportgenossenschaft e. G. m. b. H., of Auen on Elbe, is a corporation formed by a number of private barge owners; it was established in 1904 and consists of 676 members. They have at their disposal a fleet of 678 barges, aggregating 400,000 tons.

The canals and rivers are controlled by the various governments, none of which operate fleets of their own. The tendency, as is the case in all classes of German business, is toward organization upon the "community of interests" basis. Thus there is an Interessen-Geweinschaft between the Oesterreichische Nordwest Dampfschiffahrts-Gesellschaft, the Deutsch Oesterreichische Dampfschiffahrt Actien Gesellschaft, the "Elbe" Dampfschiffahrts Actien-Gesellschaft, for their mutual advantage. This fusion was created in 1907, and under it the first-named companies leased to the Vereinigte Elbeschiffahrts-Gesellschaft their entire business with their fleets, and obtained a proportionate share in the resulting profits.

A few inland coal dealers at Berlin and elsewhere operate river vessels of their own for the transportation of bituminous and brown coal from Bohemia. There is no important ownership of vessels on the Elbe by railroads or producing concerns; neither are any fleets of merchant vessels owned or operated by public authorities.

It was feared that when the combination referred to above, the Vereinigte Elbeschiffahrts-Gesellschaft, A. G., took over other important interests it would exercise a monopoly of Elbe traffic. However, very soon after the formation of this trust, the Deutsch Böhmische Dampfschiffahrts-Gesellschaft was organized, and there are a number of smaller concerns operating direct steamship and towing services, and, finally, the innumerable barge owners have an association by means of which they compete successfully against the large companies, and could strike back effectively in the event of a rate war breaking out. Since the individual barge owners are associated the difference between their organization and the very power-

ful one first described is one of degree rather than of principle. Perhaps it might be stated that the individual barge owner carrying on his own business in his own limited way no longer exists.

### V. TERMINAL FACILITIES.

The Hamburg port equipment and organization probably has no superior in the world. Vessels engaged in inland navigation also have full use of the Hamburg quays, but there are no wharves or other terminal facilities specially constructed for river craft, other than a few sheds and derricks for the collection and manipulation of general merchandise, and these are owned and operated by the Vereinigte Elbeschiffahrts-Gesellschaft.

As I have already stated, vessels employed on the inland waters usually come alongside the seagoing vessels in the port of Hamburg, from which they receive cargo, or into which they discharge their own. The city quays are well equipped with cranes of every description and modern apparatus for handling grain and bulk articles. In this respect the port is certainly not in advance of first-class American ports—probably the contrary.

Railroad tracks are located alongside nearly all the quays of Hamburg, thus permitting a direct exchange of traffic between the railroads and seagoing vessels. The track facilities are seldom used in connection with inland navigation, as the river craft have no need for such facilities. The only harbor in the port of Hamburg in which river barges lay is chiefly a winter refuge, and, indeed, has no railroad connections at all.

The docks of Hamburg, together with the free port, are all property of the State, managed in the interest of the general public. Such canal terminals as exist are privately owned and operated, but the real terminals are those created by nature, as already explained.

#### DOCKAGE FEES AND TERMINAL CHARGES.

[Extract from the Service Regulations and Tariff of Fees regarding the quays of Hamburg.]

SEC. 22. For the use of the quays, including the quay sheds, the Hamburg quay administration charges the following fees:

I. A tonnage fee:

(*a*) For discharging and loading and for discharging or loading within not more than five times 24 hours, 17.5 pfennigs per cubic meter net tonnage (4.16 cents per 1.308 cubic yards net tonnage).

(*b*) For every additional 24 hours of demurrage or fraction thereof, 3.5 pfennigs per cubic meter net tonnage (0.8 cent per 1.308 cubic yards net tonnage).

This fee is payable by the ship alone.

II. A loading fee on all goods discharged or loaded over the quays of 10 pfennigs per 100 kilos (2.38 cents per 220 pounds). Of this loading fee seven-tenths are payable by the ship and three-tenths by the owner of the merchandise. The quay administration collects the entire fee from the representative of the vessel, leaving it to his discretion to collect from the owners of the goods their share in the fee.

The administration is authorized to control the weight of shipments of goods. If the same is found to be in excess of 5 per cent over the declared weight the regular weighing fee (as per tariff referred to later) is collected. On goods in packages of an average weight usually entered in cargo manifests of ships according to the number of packages (such as barrels of herrings, hogsheads of wine, etc.) the weight is fixed by the quay administration. If other goods are found to be entered in cargo manifests without the weight being stated, and such weight not having been ascertained otherwise, the administration can cause such goods to be weighed at the expense of the ship's representative, charging the regular weighing fees.

III. If goods have been discharged at the quay from a seagoing vessel and are transferred at the same quay to another seagoing ship, or to a vessel engaged in coastwise trade, or to a barge, etc., the loading fee for the reloading of the goods is reduced to 5 pfennigs per 100 kilos (1.19 cents per 220 pounds) and the tonnage fee for the vessel receiving the merchandise to 12 pfennigs per cubic meter (2.86 cents per 1.308 cubic yards) net tonnage, provided the use of the quay by the latter ship is restricted to the loading of such goods and is not intended for other purposes.

IV. (*a*) At the time of delivery of goods imported by sea, payable by the recipient of the goods:

1. Landward, except when delivered into railroad car (a special tariff of fees being prescribed for the service of the quay railroad), 8 pfennigs per 100 kilos (1.90 cents per 200 pounds).
2. Into open or covered harbor barges, free.
3. Into river craft, 5 pfennigs per 100 kilos (1.19 cents per 220 pounds).

(*b*) At the time of delivery of goods destined for exportation by sea, payable by the deliverer of the goods:

1. Delivered from land, 8 pfennigs per 100 kilos (1.90 cents per 220 pounds).
2. Delivered by water, 10 pfennigs per 100 kilos (2.38 cents per 220 pounds).

SEC. 23. If goods, such as bulk articles, are discharged over the quay directly into railroad car, or vice versa, without being stored in the quay sheds or on the quays, the following fees are charged instead of those above stated:

1. On fertilizers of all kinds, pig iron, ore, nitrate, rice, asphalt, lead, coal and coke, cement, grain in bags, stones, sand, sugar, salt, kainite, slate, flagstones, railroad rails and ties, cottonseed meal and cake, raw-iron goods, bar iron, magnesium chloride, crude zinc, as well as all other metals of low value, iron and steel wire (also barbed wire) in rings or embaling, coal briquettes, gypsum, and ice in blocks, and structural iron, 5 pfennigs per 100 kilos (1.19 cents per 220 pounds).
2. On cotton, hides, oil cake, wool, jute, herrings, potatoes, corkwood, dyewoods, empty bottles (loose, not packed) in crates, sheet iron, hay in bales, machinery, and meat, 7.5 pfennigs per 100 kilos (1.78 cents per 220 pounds).

The Hamburg Department of Commerce and Navigation has the right to designate other goods as bulk articles of the foregoing classes subject to the lower rates of charges.

This fee is payable by ship and recipient, or deliverer, each party paying one-half; however, the whole amount is collected from the ship's representative, who has the right to charge the moiety to the owner of the goods.

For the transportation of the said bulk goods over the tracks of the quay and harbor railway, the harbor railway fee, reduced to 3 pfennigs per 100 kilos (0.71 cent per 220 pounds), is charged. This reduced rate is only applied when the goods pass directly from ship into car, or vice versa, without being stored on the quay.

If goods from a ship or a railroad car thus stored on the quays are, in consequence of a change in the disposition as to their destination, not loaded into car or ship, but are removed from the quay by cart or river craft, the fee prescribed in section 22 (IV), payable by the representative of the shipment, is charged in addition to the fee prescribed in the first paragraph of this section, and in such case the fee also amounts to 5 pfennigs per 100 kilos (1.19 cents per 220 pounds) when the goods are transferred into open or covered harbor barges.

SEC. 24. If, with the consent of the quay administration, goods are delivered at a quay for a seagoing vessel which does not load such goods from alongside the quay, an additional fee (besides the one prescribed in section 22 (IV b)) is payable by the representative of the ship for the dispatch of the goods ex quay to ship. Such charges are as follows:

1. If the ship has, during the same voyage, used the quay previously for discharging or loading, or for both, and has therefore paid the tonnage fee, 10 pfennigs per 100 kilos (2.38 cents per 220 pounds).
2. If not, 20 pfennigs per 100 kilos (4.76 cents per 220 pounds).

In all other cases where goods have been accepted, exceptionally, by the quay administration, which have neither been discharged from seagoing vessels nor are intended to be loaded into such vessels, a fee of 20 pfennigs per 100 kilos (4.76 cents per 220 pounds) is charged for the receiving and delivering of the goods, payable by the party at whose instance the work was done.

SEC. 25. The fees for the use of the collecting and distributing shed in connection with the transportation of goods over the lines of the harbor and quay railroad are fixed by the "Eisenbahn-Kai-Regulativ" of August 15, 1888.

A reduction of the tariff rates is granted, except in cases of the kind mentioned in section 23, on bunker coal directly transferred from railroad car to vessel, without the assistance of employees of the quay administration or the use of material, tools, etc., belonging to it, the reduced charge being 1 pfennig per 100 kilos (0.24 cent per 220 pounds). However, the minimum fee is 1 mark (23.8 cents) per railroad car.

SEC. 26. (No charge is made for the storage of goods on the quays and in the quay sheds during the first two workdays after the day of discharge or delivery.) After such two free days the storage fee amounts to 2 pfennigs per 100 kilos (0.48 cent per 220 pounds) per workday; however, some articles it is reduced or increased as follows:

1. Grain, oil seed, flour, legumes, and cattle feed of all kinds, including oil cake, 1 pfennig per 100 kilos per workday (0.24 cent per 220 pounds).

2. Empty barrels, baskets, boxes, etc., 6 pfennigs per 100 kilos per workday (1.43 cents per 220 pounds).

3. Machinery, the storage of which is permitted in the open, 10 pfennigs per 100 kilos per month (2.38 cents per 220 pounds).

4. Bulk goods stored on the quay (sec. 23), 2 pfennigs per 100 kilos per month (0.48 cent per 220 pounds).

On goods delivered on the quays, but removed again therefrom (sec. 24), the storage fee is charged from the date of delivery.

SEC. 27. The weighing charges, payable by the person at whose instance the work is done, are as follows:

1. Weighing goods at the time of storing or receiving, 6 pfennigs per 100 kilos (1.43 cents per 220 pounds).

2. Weighing and repiling goods, 10 pfennigs per 100 kilos (2.38 cents per 220 pounds).

3. Weighing goods by the piece, 12 pfennigs per 100 kilos (2.86 cents per 220 pounds), but not less than 6 pfennigs (1.43 cents) per package.

The weighing of goods loaded into railroad cars, in order to ascertain the weight for the railroad, is done free of charge, except for bulk goods (sec. 23) directly transshipped, if weighing of the goods on the part of the quay administration is desired by the owner. In such cases a weighing fee of 4 pfennigs per 100 kilos (0.95 cent per 220 pounds) is charged.

The foregoing weighing fees Nos. 1, 2, and 3 may also be charged when the weighing is done by the owner of the goods by means of his own instruments and with his own men.

SEC. 28. In the way of cranage on packages or pieces weighing more than 2 metric tons (2,200 pounds), including the use of chains, the following charges are made:

| | Per 100 kilos (220 pounds). | | | |
|---|---|---|---|---|
| | In transshipment from railroad to ship, and vice versa. | | In all other cases. | |
| Pieces weighing (metric tons)— | *Pfs.* | *Cts.* | *Pfs.* | *Cts.* |
| 2 to 3 tons | 5 | 1.19 | 10 | 2.38 |
| 3 to 5 tons | 10 | 2.38 | 20 | 4.76 |
| 5 to 7½ tons | 15 | 3.57 | 25 | 5.95 |
| 7½ to 10 tons | 20 | 4.76 | 30 | 7.14 |
| 10 to 12½ tons | 25 | 5.95 | 35 | 8.33 |
| 12½ to 15 tons | 30 | 7.14 | 40 | 9.52 |
| 15 to 17½ tons | 35 | 8.33 | 45 | 10.71 |
| 17½ to 20 tons | 40 | 9.52 | 50 | 11.90 |
| 20 to 25 tons | 45 | 10.71 | 55 | 13.09 |
| 25 to 30 tons | 50 | 11.90 | 60 | 14.28 |
| 30 to 35 tons | 55 | 13.09 | 65 | 15.47 |
| 35 to 40 tons | 60 | 14.28 | 70 | 16.66 |
| 40 to 50 tons | 65 | 15.47 | 75 | 17.85 |
| 50 to 60 tons | 70 | 16.66 | 80 | 19.04 |
| 60 to 70 tons | 72½ | 17.25 | 82½ | 19.64 |
| 70 to 80 tons | 75 | 17.85 | 85 | 20.23 |
| 80 to 90 tons | 77½ | 18.45 | 87½ | 20.83 |
| 90 to 100 tons | 80 | 19.04 | 90 | 21.42 |
| 100 to 110 tons | 82½ | 19.64 | 92½ | 22.02 |
| 110 to 120 tons | 85 | 20.23 | 95 | 22.61 |
| 120 to 130 tons | 87½ | 20.83 | 97½ | 23.21 |
| 130 to 140 tons | 90 | 21.42 | 100 | 23.80 |
| 140 to 150 tons | 100 | 23.80 | 100 | 23.80 |

If the loads are desired to be deposited longer than is necessary for the transfer, one-half of the cranage is charged for the second lifting, besides the regular storage fees.

SEC. 29. For work performed outside the regular hours of labor, an additional fee is charged for every discharging and loading gang, as follows: Until 10 p. m., 5 marks ($1.19) per hour or fraction thereof after 10 p. m., 7.50 marks ($1.78).

On Sundays and holidays the additional fee is 15 marks ($3.57) for every discharging or loading gang.

SEC. 30. The minimum charge of any kind under the foregoing tariff is 30 pfennigs (7.14 cents). Fractions of 100 kilos are counted a full 100 kilos, and bills are always rendered in round figures.

SEC. 31. For the issuance of a certificate, as well as for the filing of an application for the storage of goods, a fee of 1 mark (23.8 cents) is collected.

For the issuance of a certificate regarding the partial delivery of a shipment, a fee of 30 pfennigs (7.14 cents) is charged.

For the repairing of packings and for other extraordinary work, 20 per cent thereof is charged in addition to the actual cost or expense.

## VI. TOLLS AND FREIGHT RATES.

Tolls are not charged on German rivers, but only on artificial canals. The following is the tariff of fees per ton of 1,000 kilograms (2,200 pounds) in effect on the Elbe-Trave Canal, which is within this jurisdiction, and payable when vessels pass the pay stations at Lauenburg and Bussau:

1. On goods transported, namely:[1]

| | Pfennigs. |
|---|---|
| Class I | 11 ($0.026) |
| Class II | 9 ( .021) |
| Class III | 7 ( .016) |
| Class IV | 5 ( .011) |

The minimum charge is the fee payable by an empty vessel, as stated in paragraph 2.

2. On empty vessels, 0.2 pfennig ($0.000476) per ton capacity.

3. On tugs, without ships in tow, 1 mark ($0.238).

4. On passenger ships, 0.5 pfennig ($0.00119) per capita of persons allowed to be transported. (This fee is charged only when such ships have passengers on board; otherwise a fee according to paragraph 2 is charged.)

5. On fishing vessels, small sailing yachts, and other small craft not measured and used for the transportation of goods, if accompanied by a vessel of one of the above classes, 50 pfennigs ($0.119); otherwise, 2 marks ($0.476).

6. On rafts, 15 to 20 pfennigs ($0.035 to $0.047) per 10 square meters (107.64 square feet) of surface, according to the kind of timber used.

7. On goods transported on rafts, 50 pfennigs ($0.119) per raft.

8. On ships permitted to pass the locks ahead of others arrived before:

(*a*) Laden vessels, passenger boats with passengers on board, tugs not towing, and rafts, 50 per cent additional charge to the regular fee.

(*b*) Empty vessels, 4 pfennigs ($0.0095) per ton capacity.

[1] Goods are graded according to the general value and divided into four classes, for which a lengthy list exists.

9. For the use of landing stages, namely:

(*a*) For discharging and loading of goods, per ton, if more than 3 tons are moved:

| | Pfennigs. | |
|---|---|---|
| Class I | 6 | ($0.0143) |
| Class II | 5 | ( .0119) |
| Class III | 4 | ( .0095) |
| Class IV | 3 | ( .0071) |

(*b*) For the moving of rafts, 4 pfennigs ($0.0095) per 10 square meters (107.64 square feet) of surface.

Exempt from the payment of fees are goods and other articles which are the property of the German Empire, the King of Prussia, and the States of Lübeck and Prussia, dinghies belonging to large vessels and passing the pay stations with the latter, and tugs admitted by the canal administration.

There are no official tariffs for the transportation of freight on rivers and canals, as there is considerable competition and the rates fluctuate materially according to the demand for tonnage. In my report, dated August 16, 1909, examples were supplied of the comparative freight rates on the same classes of goods by rail and water, and from that report I quote a few of those examples:

[Rates per ton-mile.]

| | By rail. | | By water. | |
|---|---|---|---|---|
| | Distance. | Rate. | Distance. | Rate. |
| | *Miles.* | | *Miles.* | |
| Hamburg–Cologne | 267 | $0.0085 | 342 | $0.0049 |
| Hamburg–Kiel | 68 | .0109 | 87 | .0082 |
| Hamburg–Magdeburg | 156 | .0096 | 181 | .0035 |
| Hamburg–Lübeck | 41 | .0127 | 50 | .0142 |
| Hamburg–Bremen | 71 | .0111 | 93 | .0076 |
| Hamburg–Berlin | 174 | .0097 | 233 | .0030 |
| Hamburg–Breslau | 379 | .0075 | 493 | .0030 |
| Hamburg–Dresden | 286 | .0083 | 351 | .0035 |

Freight rates on the Elbe have fluctuated from 14 to 42 pfennigs ($0.033 to $0.099) within one month. Much depends, as respects that particular river, upon the demand for tonnage for return cargo, as the Elbe is a river upon which freight is carried both ways, while on the Rhine freight is carried chiefly in one direction. Thus it may happen that there is an excessive demand for tonnage for freight from Hamburg to the interior and an absence of cargo for the return trip. At other times precisely the opposite situation may exist, and at still other times the demands for tonnage in both directions may about balance. Offers for transportation are made upon the Hamburg bourse every day, just as stocks and bonds and merchandise are offered for sale, and while the existence of large combinations of freight carriers tends to steady rates the changes are, nevertheless, frequent and rapid. The following extracts from reports issued by the Hamburg Chamber of Commerce set forth the German view of the situation in respect to river transportation:

1901. Development of river navigation not favorable. After a long winter and late opening of navigation business developed briskly, but calmed down in summer. At times water so low in the Elbe that barges to the middle Elbe could

only be half laden. Traffic above Dresden could only be maintained with difficulty. Same condition prevailed on the Oder. Deficiency in shipments of bulk goods depressed freight rates, and even large shipments of raw sugar and salt did not relieve the situation.

1902. The year a very unfavorable one. Due to general depression, freight rates were low, and the rise in these rates generally observed in spring because of the quantity of goods accumulated during winter failed to set in, because the preceding winter was very mild. Private barge owners suffered considerably under this situation. In fall freight rates on downward-bound goods increased, but not on those moved in the opposite direction. Improvement was not of a long duration, as winter set in early and navigation was consequently closed. It is hoped, however, that the deficiency caused thereby will be covered by the coming spring business.

1903. The situation remained unchanged in general. Although the quantity of goods shipped is increasing (chiefly sugar for exportation) and channel depth is generally favorable, competition makes itself too much felt; freight rates and towing charges remain too low, so that the business is not remunerative. In fall rates go up, chiefly on account of general improvement of commerce. The unsatisfactory situation in river navigation caused the three largest Elbe shipping companies to unite their interests by means of a fusion, hoping by doing so to be able to utilize their floating material more favorably and otherwise to obtain better results, chiefly by means of quicker transportation, without increasing freight and towing rates. Improper action on the part of the combine is not feared, as the same in no way represents the entire Elbe shipping, but would have to count always with keen competition by outsiders. It is hoped that this step is one toward sanitation of navigation on the Elbe, not alone to the benefit of the latter itself, but also of trade in general.

1904. Efforts to improve conditions in Elbe shipping business by means of further combinations have become useless, due to the extraordinary drought. In consequence of the latter the level of the Elbe sinks to 2.3 centimeters (0.9025 inch) below the zero mark, and in many places the river bed dried out entirely, an extraordinary occurrence. The prolonged drought caused shipping to be interrupted during fully three months, and goods usually transported over the waterways had to be shipped by rail or stored, thus in many cases being out of reach of their owners. In October, when navigation was resumed, an extraordinarily large demand on barge tonnage made itself felt, so that in many places there were not sufficient vessels available. A considerable rise in freight rates was the consequence, notwithstanding the profit derived therefrom does not suffice to make good for the previous deficiency. The individual owners of single barges suffer the greatest losses.

1905. A lively traffic both ways enabled owners of barges and river steamers to maintain freight rates at a remunerative level. Channel depth was generally favorable, so that the tonnage of the barges could be wholly utilized throughout the year. In general, the year was one likely to repair the damages of previous years.

1906. The expected rush as a forerunner of the increase of tariff rates going into effect on March 1 did not set in to the degree generally anticipated. Nevertheless business was favorable, and remunerative freight rates were paid. Later in the year freight rates receded, particularly so after the agreement between the Elbe steamship companies had been canceled.

The channel depths recede so considerably during August that in the beginning of September the companies in Dresden are compelled to discontinue shipping for a short while. Through this drought freight rates went up, and inasmuch as the fall business set in rather early the increased rates formed a favorable basis for the rest of the year. However, a strike breaking out in the middle of October and lasting until November somewhat influenced the situation. In general, the year was not a profitable one.

1907. River navigation looks upon this year as a favorable one, and daily freight rates were generally high; only during the last month business turned slack. River shipping business is influenced somewhat by the strike of the longshoremen in Hamburg, inasmuch as this strike broke out at a time when business was favorable everywhere. In summer the Elbe shipping companies, which come into consideration for the local place, namely, the Privatschiffer Transportgesellschaft Dampfschiffahrts Aktien-Gesellschaft, the "Elbe, and the Deutsch-Oesterreichische Dampfschiffahrts A. G., leased their business to the Vereinigte

Elbeschiffahrts Gesellschaften, A. G., so that the latter obtained a monopoly-like position in the Elbe trade. However, in the fall a new enterprise, the "Deutsche Böhmische Dampfschiffahrtsgesellschaft," was established, and thus new competition created.

1908. The year was one unfavorable to a high degree. The quantities of bulk articles shipped during spring and summer were considerably smaller than in the last preceding year. The effect was one particularly disadvantageous, as navigation could be opened early in the year, and as high water prevailed everywhere almost throughout the summer so that barges could be loaded to their maximum capacity. As business on the Oder was also slack, keen competition by ships generally employed on that river made itself felt on the Elbe, particularly in trade with the Havel. Freight rates remained on an extraordinarily low level throughout the year, and after a rise of short duration in July sank still lower during the latter six months as a consequence of lack of demand for tonnage.

Goods transported upon express steamers, which are 40 per cent faster than the slow boats, pay a rate which is double and sometimes which is three times as high as ordinary river freight rates.

There is no prorating arrangement between the water lines and state railways. There is, in fact, great competition between these two systems of transportation. The railroads have met the situation, to some extent, by offering favorable export rates on certain classes of goods. There is no legislation in Germany regarding the relations between the railroads and inland-water systems of transportation, neither is there any governmental restriction as to the lowering of railroad rates for purposes of competition with water rates. It probably would be regarded as contrary to public policy to institute a system of railway tariffs which might break down the river-shipping interests, which, in the long run, can handle bulk freight at a lower cost per ton-mile than is possible by railroad. It is undoubtedly the desire of the German people to maintain river and canal transportation up to the point of its highest efficiency.

German shippers insure their goods on inland waterways. The risk is not assumed by the carrier, although the latter frequently attends to the formalities, acting in the capacity of insurance agent, the premium in this case being added to the freight rates which are quoted either with or without insurance, according to the desire of the shipper.

*Goods shipped from Hamburg to the interior by rail.*

| | Food products. | Building material and fuel. | Raw products and semimanufactures. | Dry goods and fancy articles. | Products of arts and industries. | Total. |
|---|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1899 | 353,393 | 99,878 | 599,339 | 14,499 | 96,418 | 1,163,527 |
| 1900 | 360,331 | 154,801 | 675,254 | 20,335 | 154,060 | 1,306,414 |
| 1901 | 338,459 | 100,589 | 675,732 | 15,448 | 92,124 | 1,222,352 |
| 1902 | 357,298 | 98,063 | 615,004 | 15,949 | 83,985 | 1,170,299 |
| 1903 | 355,811 | 72,464 | 609,511 | 14,763 | 81,990 | 1,134,539 |
| 1904 | 505,096 | 105,781 | 926,791 | 20,587 | 120,576 | 1,678,822 |
| 1905 | 523,531 | 186,761 | 730,650 | 21,541 | 135,290 | 1,697,773 |
| 1906 | 529,165 | 128,156 | 920,112 | 24,951 | 161,209 | 1,763,593 |
| 1907 | 663,971 | 147,446 | 964,696 | 24,918 | 172,801 | 1,973,832 |
| 1908 | 606,907 | 126,253 | 961,823 | 22,604 | 161,655 | 1,879,246 |

*Goods arrived in Hamburg from the interior by rail.*

| | Food products. | Building material and fuel. | Raw products and semimanufactures. | Dry goods and fancy articles. | Products of art and industries. | Total. |
|---|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1899 | 341,559 | 1,200,091 | 254,712 | 46,860 | 357,570 | 2,200,792 |
| 1900 | 398,400 | 1,179,536 | 295,659 | 51,987 | 435,295 | 2,360,877 |
| 1901 | 386,326 | 1,277,863 | 324,106 | 46,557 | 388,484 | 2,423,336 |
| 1902 | 408,493 | 1,308,084 | 309,993 | 50,254 | 412,337 | 2,489,161 |
| 1903 | 412,527 | 1,352,557 | 276,314 | 53,265 | 451,358 | 2,546,021 |
| 1904 | 445,144 | 1,513,624 | 474,039 | 57,807 | 546,200 | 3,036,814 |
| 1905 | 335,718 | 1,535,060 | 367,433 | 59,868 | 567,075 | 2,865,154 |
| 1906 | 416,840 | 1,774,878 | 390,578 | 66,050 | 640,063 | 3,288,409 |
| 1907 | 466,206 | 1,816,107 | 408,484 | 67,789 | 700,306 | 3,458,892 |
| 1908 | 452,152 | 1,780,965 | 434,523 | 58,382 | 631,455 | 3,357,477 |

*Goods shipped from Hamburg to the interior by water.*

| | Food products. | Building material and fuel. | Raw products and semimanufactures. | Dry goods and fancy articles. | Products of art and industries. | Total. |
|---|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1899 | 1,164,299 | 618,283 | 1,679,596 | 6,580 | 45,370 | 3,514,108 |
| 1900 | 1,074,893 | 763,396 | 1,560,558 | 5,764 | 52,603 | 3,457,214 |
| 1901 | 1,397,165 | 574,532 | 1,457,034 | 6,546 | 54,664 | 3,489,941 |
| 1902 | 1,227,662 | 619,386 | 1,431,153 | 8,259 | 49,424 | 3,335,884 |
| 1903 | 1,272,908 | 739,812 | 1,729,335 | 7,264 | 50,449 | 3,799,768 |
| 1904 | 954,756 | 561,282 | 1,456,035 | 4,098 | 36,845 | 3,013,016 |
| 1905 | 1,571,146 | 1,038,809 | 1,964,558 | 6,732 | 62,220 | 4,643,465 |
| 1906 | 1,509,215 | 1,263,463 | 2,171,542 | 4,347 | 59,417 | 5,007,984 |
| 1907 | 1,609,448 | 1,811,191 | 2,347,708 | 7,727 | 68,069 | 5,844,143 |
| 1908 | 1,263,246 | 1,994,136 | 2,193,764 | 7,876 | 63,702 | 5,522,724 |

*Goods arrived in Hamburg from the interior by water.*

| | Food products. | Building material and fuel. | Raw products and semimanufactures. | Dry goods and fancy articles. | Products of art and industries. | Total. |
|---|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| 1899 | 1,185,613 | 617,360 | 506,380 | 1,729 | 124,358 | 2,435,440 |
| 1900 | 1,312,343 | 557,542 | 596,443 | 1,529 | 139,063 | 2,606,920 |
| 1901 | 1,267,254 | 525,699 | 653,011 | 1,277 | 118,965 | 2,565,606 |
| 1902 | 1,141,423 | 587,681 | 588,237 | 1,807 | 130,265 | 2,449,413 |
| 1903 | 1,612,161 | 730,936 | 707,407 | 2,712 | 173,770 | 3,226,987 |
| 1904 | 979,620 | 541,157 | 532,603 | 2,294 | 122,382 | 2,178,056 |
| 1905 | 1,057,611 | 832,296 | 925,036 | 4,686 | 181,543 | 3,001,172 |
| 1906 | 1,498,088 | 969,961 | 905,350 | 5,013 | 189,385 | 3,567,797 |
| 1907 | 1,258,872 | 912,605 | 813,900 | 4,924 | 196,507 | 3,186,808 |
| 1908 | 1,241,793 | 907,232 | 755,401 | 3,980 | 174,370 | 3,082,776 |

*Vessels and rafts arrived in Hamburg from the Upper Elbe during 1908.*

| From— | Self-propelled freight steamships. | | | | | |
|---|---|---|---|---|---|---|
| | Laden. | | | Empty. | | |
| | Number. | Tonnage. | | Number. | Tonnage. | |
| | | Total. | Average. | | Total. | Average. |
| Oder | 75 | 21,313 | 284 | | | |
| Havel | 296 | 72,391 | 245 | | | |
| Saale | 126 | 38,382 | 305 | | | |
| Elbe | 2,134 | 256,965 | 120 | 67 | 9,127 | 136 |
| Elbe-Trave Canal | | | | | | |
| Total | 2,631 | 389,051 | 148 | 67 | 9,127 | 136 |

| From— | Barges in tow. | | | | | | Steam tugs. | | |
|---|---|---|---|---|---|---|---|---|---|
| | Laden. | | | Empty. | | | | | |
| | Number. | Tonnage. | | Number. | Tonnage. | | Number. | Tonnage. | |
| | | Total. | Average. | | Total. | Average. | | Total. | Average. |
| Oder | 847 | 289,616 | 342 | 6 | 1,769 | 295 | 4 | 622 | 130 |
| Havel | 1,469 | 480,957 | 327 | 5,165 | 2,004,218 | 388 | 1,082 | 104,782 | 97 |
| Saale | 555 | 189,919 | 542 | 2 | 610 | 305 | 2 | 134 | 67 |
| Elbe | 8,264 | 3,975,589 | 481 | 2,710 | 1,254,943 | 463 | 1,275 | 248,841 | 195 |
| Elbe-Trave Canal | 557 | 131,008 | 235 | 202 | 77,847 | 385 | 2 | 40 | 20 |
| Total | 11,692 | 5,067,089 | 433 | 8,085 | 3,339,387 | 413 | 2,365 | 354,419 | 150 |

## WAGES PAID ON INLAND WATERWAYS.

On express and other steamers plying on the Elbe the masters receive from 130 to 140 marks ($30.94 to $33.32) per month, the engineers from 115 to 125 marks ($27.37 to $29.75), the first mate 125 marks ($29.75), and the second mate 100 marks ($23.80). The monthly wages of the firemen amount to from 90 to 100 marks ($21.42 to $23.80), and of the deck hands to from 90 to 95 marks ($21.42 to $22.61).

Besides this, these employees receive mileage, extra compensation, as follows:

[Per kilometer.]

| Between Hamburg and | Magdeburg. | | Dresden. | | Laube. | |
|---|---|---|---|---|---|---|
| | Pfennigs. | Cents. | Pfennigs. | Cents. | Pfennigs. | Cents. |
| Masters | 6½ | 1.55 | 5 | 1.19 | 5 | 1.19 |
| Engineers | 4½ | 1.07 | 3½ | .83 | 3½ | .83 |
| First mate | 4½ | 1.07 | 3½ | .83 | 3½ | .83 |
| Second mate | 3½ | .83 | 2½ | .59 | 2½ | .59 |
| Firemen | 2 | .47 | 1¼ | .30 | 1¼ | .30 |
| | 3½ | .83 | 2½ | .59 | 2½ | .59 |
| Deck hands | 2 | .47 | 1¼ | .30 | 1¼ | .30 |

On certain other routes these extra wages are a trifle higher.

The wages of employees on barges are as follows: Mates (helmsmen), from 130 to 145 marks ($30.94 to $34.51) per month while the vessel is in service and 110 marks ($26.18) during the winter months.

Boys on barges and steamships earn wages as follows: First year, 40 to 45 marks ($9.52 to $10.71) per month; second year, 45 to 50 marks ($10.71 to $11.90) per month; third year, 55 to 60 marks ($13.09 to $14.28) per month; fourth year, 65 to 70 marks ($15.47 to $16.66) per month, with a slight extra compensation for mileage on certain routes.

Employees on barges or other towed vessels receive no extra compensation for mileage.

Many private barge owners attend to the navigation of their vessels personally, with the assistance of their wives, children, and often of other relatives as well, who in such cases frequently do not receive a fixed rate of wages, but a share in the profits.

# RIVERS AND CANALS IN THE CONSULAR DISTRICT OF MAGDEBURG.

Report by JAMES L. A. BURRELL, *Vice Consul.*

## I. PUBLIC SUPERVISION.

(*a*) The supervision over the navigable streams and canals in Prussia is in the hands of the State; in the Kingdom of Saxony, the Duchy of Anhalt, the State of Hamburg, and the Grand Duchies of Mecklenburg, which are watered by the Elbe or its tributaries, the supervision is exercised partially by special administrative bodies under the respective governments, and partially by the General Government itself.

In Prussia a uniform organization has been created for the Elbe and Saale Rivers, as well as for their tributary streams for fixed distances, in the Royal Elbstrombauverwaltung (administration of the Elbe stream), at the head of which is the Oberpræsident (roughly, provincial governor) of the Province of Saxony in Magdeburg as chief. Under the Elbstrombauverwaltung are seven water inspectorships (Wasserbauinspektionen)—two in Magdeburg, one of which supervises the lower Saale, and one each in Torgau, Tangermünde, Wittenberge, Hitzacker, and Lauenburg.

(*b*) 1. The official bodies have allowed private capital to utilize navigation for commerce, and have neither a direct nor indirect influence on the capitalization of navigation corporations.

2. For this reason reports of operation are not issued by the official bodies. The private corporations report at the close of the year on the extent of business done for the benefit of the stockholders, who make public as much of this information as they think best. (See below, under II (*b*).)

For a number of years statistics of water-borne traffic were collected at the various terminals and sent to the statistical bureau (Statistisches Amt) in Berlin for compilation and publication. But in spite of voluminous and difficult work, a perspicuous and accurate view could not be obtained. Accordingly a new system was introduced at the beginning of the year 1909, in the furtherance of which the cooperation of the navigation companies was counted upon. This system failed on account of the unreliability and refusal of the special assistance expected, so that no official statistics for the year 1909 will be compiled.

The regulation of the freight rates is wholly the affair of the navigation companies concerned.

## II. WATERWAY IMPROVEMENTS.

(*a*) Formerly the various States and official bodies collected taxes for the use of the waterways and only irregularly and in case of great need made appropriations for their maintenance and improvement. But in the course of time the activity of the State in the improvement of the waterways increased and the tolls, etc., decreased, particularly as it became necessary to compete with the railroads, until finally in 1870 all tolls and duties on the natural waterways (rivers) were abolished.

In spite of the appropriations, in some cases very large, which the State made from time to time, the conditions were still far from being satisfactory, and the Prussian Government established, therefore, in 1866 the Elbstrombauverwaltung mentioned above. From this time, with the aid of adequate appropriations, a regular and systematic method of river improvement began, which has proven extraordinarily satisfactory, owing largely to the expert and far-sighted distribution of the funds at its disposal by the central authority.

The improvements made may be classed as follows: "Coupierungen" (cuttings, the removal of impeding tongues of land, etc.), "Buhnen" (tongues of land built out into the stream in order to make a channel of even width in flat country), "Deck-und Parallelwerke" (built in case of sharp bends, particularly such with receding banks), "Grundschwellen" (subaqueous constructions to prevent any washing out of and to give support to the "Buhnen"), and Baggerungen" (dredgings). The land washed up between the constructions on the banks was planted and strengthened, thus serving on the one hand to make the banks more secure and on the other furnishing material for the corrective constructions. The lines of correction established by the stream improvement commission (Strombaukommission) appointed for the purpose were built out systematically with due consideration of local conditions, and permanent shoals and temporary deposits were removed. The winter harbors already in existence were enlarged and improved and new ones constructed. An organized river police was established and a careful marking of the changeable channel was introduced, by means of which, with the aid of reports which are telegraphed and immediately published, the boatman is able to regulate the amount, respectively the weight of his cargo. Notifications of high water and of the movements of the ice warn the boatman in time of approaching danger.

The channel established by means of the various improvements mentioned above made possible an increase in the tonnage of the vessels, a reduction in the number of the crew, and a shortening of the running time. The narrowing of the channel and the decrease of the shallows exerted a favorable influence against the formation of ice floes. Such improvements were made for the Saale and Unstrut, as well as for the Elbe, except that the construction of locks was necessary in the two rivers just mentioned.

(*b*) The improvements mentioned in the foregoing have also been made in other navigable rivers and in all cases at the expense of the State.

Expenses incurred for the benefit of inland navigation on the Elbe were as follows:

Cost of the various improvements made during the last 40 years:

| | |
|---|---|
| Expended by Prussia | $8,234,800 |
| Expended by Anhalt and Mecklenburg | 2,070,600 |
| | 10,305,400 |

Running expenses, i. e., cost of maintenance, being the average annual expenses during the last ten years:

| | |
|---|---|
| Prussia | $333,200 |
| Anhalt and Mecklenburg | 34,510 |
| | 367,710 |

Navigation on the Elbe is free.

By far the greater part of the harbors on the Elbe are the property of the Government, and serve principally to afford protection to vessels in winter. The terminal facilities in these harbors, however, which serve the interests of commerce and industry, belong to private companies, not to municipal corporations. The commercial and trade harbor of Magdeburg belongs to and is administered by the municipality. The harbor in Aken belongs to a stock company.

The fees for the harbors on the Elbe belonging to the Government are regulated to cover the cost of maintenance. Only for such vessels as use the protecting harbors are fees (Winterliegegebühren) exacted, and, in case goods are stored, there are also fees for storage (Ufergeld). The amount of the fees is different in the different harbors, corresponding to the cost of construction of the latter; the fees paid at the Torgau Harbor, for instance, being three times as high as at Lauenburg.

Expenses incurred for the benefit of navigation on the Saale and Unstrut were as follows:

Cost of various improvements during the last forty years:

| | |
|---|---|
| Prussia: | |
| For river improvements (Korrektionsbauten) | $1,225,700 |
| For building new locks | 107,100 |
| Anhalt | 102,340 |
| | 1,435,140 |

Average annual cost of maintenance during the last ten years:

| | |
|---|---|
| Prussia | $22,610 |
| Anhalt | 10,710 |
| | 33,320 |

Navigation on the Saale and Unstrut is not free, as the expense of the locks is considerable; lock toll, based on the tonnage of the vessels, is therefore exacted. The average yearly income during the last ten years from this source and others was as follows:

| | | |
|---|---|---|
| Prussia: | | |
| Lock toll | $5,712 | |
| Pasture, sand and gravel, rent | 952 | |
| | | $6,664 |
| Anhalt | | 1,428 |
| | | 8,092 |

The most important tributary of the Elbe, not only in respect to navigation, but also owing to the amount of water it brings into the main stream, is the Havel, whose various water courses were long ago united by canals, and thus made navigable. During the last 40 years the State has enlarged and improved the already existing canals and constructed new ones, and has also built new locks and harbors.

The expenses incurred by Prussia for improvements on the Havel during the last 40 years, including lakes and canals, are:

| | |
|---|---|
| For the channel of the Havel | $3,534,300 |
| Tributaries | 666,400 |
| | 4,200,700 |

Average annual cost of maintenance during the last ten years:

| | |
|---|---|
| Havel | $39,032 |
| Tributaries | 9,520 |
| | 48,552 |

As opposed to these figures, the average amount collected annually during the last ten years in lock tolls is:

| | |
|---|---|
| Havel | $209,440 |
| Tributaries | 1,428 |
| | 210,868 |

For the use of the terminal facilities, etc., on the banks, which are the property of municipalities, fees are exacted, which are so adjusted as to pay a low rate of interest on the capital invested as well as to cover the costs of maintenance.

It is further to be remarked that in the figures just given the expenses for the Spree, so far as this river is in Berlin and its immediate vicinity, are not included.

Worthy of particular mention is the Elbe-Trave Canal. This was constructed at the particular instance of the State of Lübeck, which was seriously endangered as a seaport and commercial center by the sudden growth of Hamburg and by the competition of the railroads. For these reasons a good connection with that highway of commerce, the Elbe, was of great importance to Lübeck, and although by far the greater part of the Elbe-Trave Canal is in Prussia and only a small portion in the State of Lübeck the costs were divided as follows:

| | |
|---|---|
| Lübeck | $3,820,852 |
| Prussia | 1,642,200 |
| Towns on the canal | 142,800 |
| | 5,605,852 |

The expenses incurred for that part of the Elbe under the supervision of the Elbstrombauverwaltung in Magdeburg, both for improvement and maintenance, are given for each year from 1815 to 1908, inclusive, on page 2 of the second part of the Mitteilungen der Elbstrombauverwaltung for 1907 and 1908. In these figures are included under costs of maintenance the construction of winter harbors, the inspection of ship mills, and the purchase of vessels and dwellings for the employees of the river administration. (This was a maneuver to secure the necessary appropriations from the Prussian Diet.) The expenses given in the last column for the years 1900

and following were incurred, as experience has taught that the "Buhnen" (strips of land extending into the river to regulate the current), which are protected with stone, are much more durable and offer a better resistance than those which are strengthened by planting grass, etc., thereon.

### III. FLOATING EQUIPMENT.

(*a*) 1 to 4. The self-propelled vessels used on the Elbe are the steamers which carry fast freight. The transportation of fast freight is, in comparison to ordinary freight, unimportant. The steamers used for fast freight are usually intended for the canals and are of moderate size.

On the Elbe and its tributaries, as well as on the canals, the barges are towed by steamers (side-wheel, chain-and-screw steamers). The sized and draft of the vessels is determined by the region in which they are to be used. Each vessel is officially gauged as to its tonnage, which must be clearly marked thereon.

The number, kind, material, and tonnage of the vessels domiciled on the Elbe between the German-Austrian boundary and Hamburg for the years 1872 to 1908 are given on page 20 of the "Mitteilungen," mentioned above, while the table on page 21 shows the dimensions and tonnage of the Elbe vessels which may be considered as typical for the years 1832 to 1908.

Besides the Elbe barges there are many vessels from other waterways employed in traffic upon the river, and the dimensions and tonnage of these vessels are also given on page 21 of the pamphlet in question.

The group of the smallest vessels (up to 150 tons), which were formerly used to a large extent for transporting freight longer distances, has been found too expensive for modern transportation needs, and vessels of this type are being replaced by larger boats on larger streams, while on the unimproved smaller rivers and canals they can not compete with the railroad.

Vessels of a somewhat larger size, however (150 to 250 tons), are employed to a large extent, and their number has considerably increased during the last twenty-five years.

As will be seen from the table to which has been referred, a great many barges, viz, most of those of middle size and all the large ones, are built of iron. Barges of oak last longer than those of pine, but are correspondingly more expensive.

5. As the cost of the various types of boats depends, of course, upon the material, size, and construction, it seems advisable to state the prices of such barges as are most commonly used on the Elbe at this time.

A 1,000-ton barge of pine wood costs 30,000 marks ($7,140) and lasts about twenty years; a barge of the same size built of oak costs 40,000 marks ($9,520) and can be used thirty to thirty-five years; built of iron, a vessel of the same kind and size costs 55,000 marks ($13,090) and lasts about fifty years. A 600-ton iron barge costs 35,000 marks ($8,330) and one of the same tonnage built of wood 20,000 to 25,000 marks ($4,760 to $5,950).

Experience has taught that steamers to be used for towing pay best when they have engines with 1,000 horsepower. Such a steamer

with all the modern appliances, etc., costs 250,000 marks ($59,500) and can, when the height of the water is normal, tow a train of barges which carry together 100,000 centner (11,000,000 pounds) freight from Hamburg to Magdeburg (300 kilometers, or 186 miles) in from four to five days. These vessels are used only on the Elbe and are side-wheel steamers. Typical for the tributaries and canals are screw steamers 30 meters (98 feet) long and 5 to 6 meters (16 to 19 feet) broad, which has engines of from 180 to 200 horsepower and cost 50,000 marks ($11,900). On the Elbe such a steamer can tow barges up to 20,000 centner (2,200,000 pounds), but the amount of coal consumed is comparatively large and the length of time greater than in the case of the larger steamers described.

6. Coal oil is transported up the Elbe in specially constructed iron tank ships of from 1,200 to 1,300 tons, which go to Magdeburg and Dresden, and have special quays where they are filled and emptied by means of pumps.

Some barges are specially fitted out to transport acids.

At the instance of the Bohemian and South German breweries the Elbe shipping companies have had special barges built for the transportation of beer. These vessels are provided with ice machines and cold-storage rooms by means of which the temperature can be regulated, the advantages thus provided over transportation by rail are the following: A quiet carriage without any shaking, such as is impossible on the railroad; an even temperature, which is necessary, if the beer is to retain its excellence, and saving of freight costs.

Worthy of mention are, further, the barges which are used to transport fruit to Berlin from Bohemia. These are built of good wood in Bohemia and are sent with a full cargo to Berlin, where their destiny is fulfilled, as they are then taken apart and the wood sold for building purposes. The amount thus realized covers at least the costs of material and labor.

In 1863 chain navigation (the tugs being drawn along a chain in the river) was introduced and, in course of time, various companies utilizing paddle-wheel steamers for towing came into existence. For a great many years efforts were made to consolidate the two largest German companies, the "Kette" and the "Vereinigte Elbe und Saaleschiffe," which finally led to success in 1904, when the "Vereinigte Elbschiffahrts-Gesellschaften" was formed. This new corporation began operations January 1, 1904, with a share capital of $2,618,000. The company had at its disposal 33 chain steamers, 19 express steamers (for fast freight), 23 smaller-sized harbor steamboats, and 308 large and 183 small barges. The number of hands employed on these vessels was 2,242.

In February, 1904, various independent companies along the Elbe formed an association based on an equal division of profits and expenses under the name of "Privatschiffer-Transport-Genossenschaft, G. m. b. H. (limited), Sitz in Magdeburg (main office in Magdeburg)." The objects of this association were to attend to (1) the freight transportation business at the stations along the Elbe and its tributaries, (2) to secure impartial treatment in the loading of the ships of its members in regular order, (3) the fixing of rates for the transportation of freight on the Elbe and its tributaries, (4) an equal distribution of the expenses of management among its members, according to the number of shares owned.

The transportation association developed favorably. In the spring of 1905 it had 1,100 members and, in round numbers, 1,200 vessels, with a capacity of 700,000 tons and valued at $5,950,000 to $6,188,000. In order to be always sure of having the steam power requisite for towing their vessels the association acquired in the course of time the majority of the shares of the "Deutsch-Oesterreichischen-Dampfschifffahrts-Aktiengesellschaft," and also succeeded in paving the way for a more intimate cooperation with the "Elbe-Dampfschifffahrts-Aktiengesellschaft."

Thus there were at the close of 1906 two powerful organizations in competition for the through water-borne traffic of the Elbe, viz, the "Vereinigte Elbe-Schifffahrtsgesellschaft," connected with the "Oesterreichische Nord-West-Dampfschiff-Gesellschaft," on the one side, and the "Privatschiffer-Transport-Genossenschaft," combined with the "Deutsch-Oesterreichische Gesellschaft," on the other.

When the association first mentioned was founded, viz, January 1, 1904, its aim was to put the enterprise on a better paying basis, and this may be considered as having been accomplished. Its further endeavors were bent on steadying the rates and keeping them, by economical management, at such a reasonable height that commerce and traffic would not be unfavorably affected.

The association did not accomplish this object, nor was it possible to do so as long as another association, as powerful as itself and operating independently, was in existence. The negotiations carried on in 1907 for the purpose of closely uniting these two influential associations led to a combination covering all the floating stock of the Privatschiffer-Transport-Genossenschaft, the Deutsch-Oesterreichische Dampfschifffahrts-Gesellschaft and the Elbe Dampfschiff-Gesellschaft. The contract went into effect July 1, 1907, and, being merely provisional, its duration is short, as it expires at the close of 1916. This corporation has at its disposal a fleet of vessels consisting of 30 chain steamers, 71 paddle-wheel tugs fitted out with engines having from 250 to 1,200 horsepower, 3 back-wheel steamers, 19 express steamers (170 to 250 horsepower), 37 screw steamers, 419 barges of its own having a tonnage of from 200 to 1,300 tons, 700 hired barges, and 235 lighters.

The freighters regarded this combination of the five powerful companies with distrust, for they expected higher rates for freight and towing. These fears, however, were soon dispelled, not only by the fact that even after this union had taken place there was still a considerable number of steamers and barges—outsiders—on hand, but also by the founding of a new enterprise. As early as 1907 the "Neue Deutsch-Böhmische Elbe-Schifffahrts-Aktiengesellschaft," with a capital of $714,000, was formed under the supervision of the Magdeburger Privat-Bank of this city (now Mitteldeutsche Privat-Bank), and began operations in the autumn of 1907. At the present time this company has at its command 14 tugs, total horsepower 8,500; 57 barges of its own, and 70 that are hired.

The following companies also operate on the Elbe: The "Neue Norddeutsche Flussdampfschiff-Gesellschaft," in Hamburg, 9 steamers; "Schlesische Dampfer Compagnie Aktien-Gesellschaft," in Breslau, 10 steamers; Mathias Burmeister, Lauenburg, 6 steamers; further, about 50 smaller companies, with from 1 to 2 steamers each.

The steamboat traffic on the Oder and on the canals and streams between the Oder and the Elbe is mostly in the hands of private contractors of no great means, and their business is confined to fixed distances, for instance: Dampfschiff-Reederei Franz Ferum, from Berlin to the mouth of the Havel, 8 steamers; Emanuel Friedländer, Breslau, mainly Oder territory, 7 steamers; Lueders & Stange, Magdeburg, from Magdeburg to Lübeck, 6 steamers. Besides these, there are many other shipowners having but a few steamers each.

During times of business prosperity as many as 350 steamers, with 107,000 horsepower, have plied on the German Elbe exclusive of that part belonging to the harbor of Hamburg. In 1866, when the Elbstrombauverwaltung was established, there were only 18 steamers, with 2,900 horsepower.

8. The construction of the barges is such that they can float fully loaded when the river is at its normal height; at less favorable times they are freighted according to the depth of the water. The following is a typical instance: Last year during a period of low water vessels having a capacity of 1,000 tons could not carry more than 100 tons. The decks of the barges are built as low as possible in order to enable them to pass under the bridges when the water is high. When these Elbe barges are loaded to their utmost capacity the lowest part of their sides is only six to eight inches above the surface of the water.

### IV. OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

(*a*) As stated above, canal construction and waterway improvements have been carried on only by the State, assisted slightly at times by the communities bordering on the streams in question. The Government has no vessels for business purposes, but it does own steamers, barges, dredging machines, scows, ice-breakers, and the like; in short, vessels that serve the purpose of facilitating traffic, keeping the waterways in good condition, and removing obstacles. There is, however, an exception to this rule. Beginning with 1900 the Lübeck government has conducted the towing business on the Elbe-Trave Canal, having as its object an economical management of the locks and machinery therewith connected and the keeping down of the costs of maintenance in general; further, for the purpose of keeping the vessels running regularly, to make possible low rates for towing, and to keep these fixed as far as possible, and to put an end to the trips of vessels having no cargoes. The construction of the canal is such that it permits of towing along the shore by means of electricity, but as it does not promise to be profitable this towing plant has not yet been used. Self-propelled vessels—express steamers, steam barges, and the like—are not dependent upon the Government for towing.

(*b*) Answered above under III (*a*) (7).

(*c*) The Government owns nearly all the railroads, but it does not possess freight vessels. Neither have the railroads owned by private parties anything to do with freight traffic on the waterways.

Of the private producing and distributing concerns owning and operating vessels may be mentioned the following: Deutsch-Amerikanische Petroleum-Gesellschaft, which has its own barges; the Saccharin-Fabrik, Westerhuesen, which has a few barges for acids; and various associations of coal dealers possessing barges for

coal. In numbers the vessels owned by such concerns and by private parties when taken together do not admit of comparison with the fleets of the great shipping combinations treated above.

(*d*) No.

(*e*) Answered above under III (*a*) (7).

### V. TERMINAL FACILITIES.

(*a*) At those places having the largest amount of traffic the steamship companies own shipyards for the building of new barges and the repair of old ones. Their docks are situated in the harbors of the seaward towns, as Hamburg, Lübeck, and Stettin, and are only intended for the use of large-sized river steamers.

(*b*) The facilities of the harbor at Magdeburg-Neustadt may serve as an example of the modern methods of loading and unloading vessels. There is a basin in the harbor of 672,750 square feet (62,500 square meters) in extent, with about 1,800 meters (5,905.50 feet) quayage. This is surrounded by large warehouses intended for goods which are not conveyed further by rail or wagon. These goods are lifted up by means of electric windlasses and are put directly into the warehouses. There are 19 hoisting machines for loading and unloading vessels of all kinds located around the basin. These include 11 movable hydraulic (portal) derricks, 4 movable electric (portal) derricks, 4 movable (portal) steam derricks. There is a large space of ground with flat banks for cargoes which may be unloaded more readily by being carried by hand or in wheelbarrows, for instance, wood and stone. Goods in masses, such as fertilizing salt, which is conveyed in a loose state run through a contrivance consisting of a box and a connecting tube from the railroad car directly into the barge and there is no loss of weight whatsoever.

(*c*) The older harbors have been modernized as far as possible, and have been provided with tracks connecting with those of the railroad; the modern harbors have without exception tracks connecting immediately with the railroad. Magdeburg may be taken as an example of how a terminus is (*d*) connected with the railroad. In this city only the termini situated on the left side of the Elbe could be connected therewith, on which side of the river there are seven large companies handling the transshipping of freight and each terminal is connected with the Elbe freight station. Three of these termini belong to private parties, three are the property of the city, two thereof being leased to private parties, and the third being the harbor Magdeburg-Neustadt, managed by the city, as already mentioned. The third terminus is the property of the railroad, i. e., the Government. The tracks reaching to the banks of the river are the property of the termini with which they are immediately connected. The railroad receives fees (überführungsgebühr) for bringing its cars from the station, the amount depending on the distance the cars are run.

(*e*) Such a list does not exist.

### VI. TOLLS AND FREIGHT RATES.

(*a*) Navigation on the main streams and tributaries for which, comparatively speaking, no very heavy expenses were incurred is

free of charge. On the streams and canals with locks, so-called Schleusengelder (lock tolls) are collected. As these fees are adjusted so as to cover operating expenses they vary considerably, in very few instances yielding a surplus to pay interest on the capital invested. On canalized rivers such fees are also collected.

(*b*) The rates for towing are established by the navigation companies, and they depend upon the number of barges to be towed. High water causes high rates, as the current is more rapid and the consumption of coal greater than usual. There are no special tariffs, as the rates frequently change from day to day. Under ordinary conditions of business and with the river at a normal height it costs $214.20 to tow a barge carrying 20,000 centner (2,200,000 pounds) from Hamburg to Magdeburg, a distance of 186 miles, or 0.952 to 1.1 cents per 110 pounds, but unfavorable conditions often double this rate. The navigation companies own both steamers and barges, hence the towing charges are established by the same management. In time of great business activity the companies tow their own empty barges down the river in order to use them again as soon as possible, whereas under ordinary conditions they are allowed to drift with the current.

(*c*) The freight rates on the Elbe, which, as has been stated, are continually subject to fluctuation, are calculated according to classes.

First class: Coal, salt, ore, stone, and other heavy goods in bulk.

Second class: Grain, oils, sugar, etc.

Third class: Ordinary piece goods.

Fourth class: Piece goods which require more careful handling, such as machines, etc.

The first class is cheapest, and the rates generally increase 2.1 cents per 220 pounds with each class, but at times the increase is higher.

The chief cause which determines these fluctuations in freight rates is the height of the water in the river. In summer the river is usually very low and the barges can carry but very small cargoes, causing a scarcity of barges and an advance in the freight rates.

(*d*) The rates increase slowly with the distance of the haul, but the increase is very moderate as long as the water is fairly high, so that the vessels can travel with full cargoes, thus preventing a scarcity of barges. As has been mentioned, there are special steamers (Eilgutdampfer) for goods requiring speedy transportation.

The fluctuation in freight rates is not so great on the canals and rivers east of the Elbe as far as the Oder. The following examples will illustrate these fluctuations.

August 12, 1909, when the water was fairly low, the following rates were paid for freight, the barges being fully loaded:

| From Hamburg to— | Cents per 220 pounds. |
|---|---|
| Magdeburg (186 miles) | 4.2 to 4.5 |
| Schönebeck (195 miles) | 5 to 4.8 |
| Aken (214 miles) | 5.5 to 5.2 |
| Torgau (295 miles) | 6.9 |
| Dresden (357 miles) | 8.8 |
| Berlin, through the canal (186 miles) | 6.6 to 6.1 |
| Halle, up the Saale (258 miles) | 8.5 |

With similar conditions as regards the height of the river prevailing, but with a greater quantity of goods to be transported on barges

which, on account of the comparatively low water, could not carry their full tonnage, the rates September 25, 1909, were as follows:

| From Hamburg to— | Cents per 220 pounds. |
|---|---|
| Magdeburg | 6.6 |
| Schönebeck | 7.1 |
| Aken | 7.3 |
| Torgau | 12.3 |
| Dresden | 13.5 |
| Berlin | 9.0 |
| Halle | 13.0 |

With less favorable water conditions (the cargoes of the barges had to be considerably reduced) and a plentiful supply of goods to be shipped, the freight rates November 9, 1909, were as follows:

| From Hamburg to— | Cents per 220 pounds. |
|---|---|
| Magdeburg | 9.5 |
| Schönebeck | 10.0 |
| Aken | 10.2 |
| Torgau | 13.8 |
| Dresden | 17.1 |

From Magdeburg to Hamburg the barges are floated down the river, thus there are no charges for towing. The following rates prevailed during the last few months:

| | Cents per 220 pounds. |
|---|---|
| August 12, 1909 | 2.8 |
| September 25, 1909 | 3.1 |
| November 6, 1909 | 3.3 |

| From Aussig to— | Aug. 12. | Sept. 25. | Nov. 6. |
|---|---|---|---|
| | *Cents.* | *Cents.* | *Cents.* |
| Magdeburg (248 miles) | 2.8 | 2.8 | 3.4 |
| Hamburg (434 miles) | 3.3 | 3.5 | 4.3 |

The above figures are for goods in bulk of Class I. For piece goods the fluctuations are not so great, the rate for fast freight from Magdeburg to Hamburg being between 14.3 and 16.6 cents per 220 pounds and from Magdeburg to Lübeck 16.6 to 19 cents for the same quantity. The same rates apply from Hamburg and Lübeck to Magdeburg. It is further to be remarked that the figures given are the rates for carriage alone and do not include fees for transshipping, etc.

(*e*) Prorating between water lines and railroads does not exist for the Elbe.

(*f*) Water lines are able to compete with the railroad whenever great quantities of freight are to be hauled long distances. The canals are able to compete in the transportation of piece goods also, as on them only small vessels are used and loading and unloading is easier.

(*g*) Since the government has taken over the railroads, the "war tariffs" formerly maintained by the more powerful railroad companies were abolished; however, the Prussian Government grants such low rates for agricultural products carried by the railroad that, when the river conditions are unfavorable, they are no higher than the rates for water transportation. There are no special agreements relative to a division of the traffic; the railroad, however, concentrates a large number of empty cars at places where a large quantity of goods is expected to arrive by water, in order to be prepared to transport them further.

(*h*) The relations between rail and inland water systems of transportation are not subject to regulation.

There is no governmental restriction on the lowering of rail rates in competition with water rates.

In most cases the goods are insured by the navigation company at the request of the consignor and are billed separately. Large firms that ship regularly by water insure their goods by taking out a general policy from one of the regular insurance companies. Entries of the kind and amount of goods are made in a book and monthly settlements are made with the insurance companies. The amounts charged for insurance depend upon the kind of goods and the class of vessel in which they are shipped.

### VII. WATER-BORNE TRAFFIC.

(*a*) Goods in bulk predominate in the freight traffic on the Elbe and its tributaries. The principal articles conveyed are grain, fertilizers, ores, oils, sugar, coal, etc.

(*b*) The following works give detailed statistics as to traffic on the Elbe, the principal commodities moved, proportion and character of traffic moved in different directions, and statistics of vessel movement and traffic:

Die Statistik des Deutschen Reiches Die Binnenschifffahrt im Jahre 1908. Verlag von Puttkammer & Muehlbrecht, Berlin.

Deutsche Wasserstrassen und Eisenbahnen in ihrer Bedeutung für den Verkehr. Gehauer-Schwetschke Druckerei & Verlag, Halle a. Saale.

Mitteillungen der Elbtsrombauverwaltung für die Elbe 1907–8. E. Bänsch jun., Magdeburg.

Eine Studie über die Elbschifffahrt. Dr. Fischer, Magdeburg. Verlag von Gustav Fischer, Jena.

(*c*) Package freight does not amount to over 5 per cent of the total.

The local traffic is also of little importance. Brickyards, sugar refineries, and the like, which are located far from the railroad but near to waterways, come into consideration, i. e., the water route is resorted to only where unfavorable conditions relative to the railroad exist, as navigation can not compete with the railroad unless great distances are to be covered.

(*d*) The hands employed on the vessels have to prove their ability for the tasks for which they are hired by passing an examination. Schools for special work, as well as continuation schools, have been established for the boatmen. The regulations in force apply particularly to captains and steersmen.

Wages paid per month: Crew, $26; steersmen, $38; captains, $43 to $48.

The latter also receive mileage money, i. e., an extra compensation, determined by the distance traveled.

The workmen at the termini do chiefly piecework, very few being engaged at fixed wages.

Besides the works mentioned in the body of the report, the following works were consulted:

Zeitschrift für Binnenschifffahrt. Berlin, 1907.
Conrads Jahrbücher, Jahrgang, 1903.
Die Deutschen Ströme von Meidinger. Leipzig.
Der Elbe-Trave Canal. Denkschrift, 1900.
Mittellungen der Vereinigten Elbschifffahrts-Gesellschaften. Dresden, 1907.
Führer auf den Deutschen Schifffahrtsstrassen. Berlin, 1905.
Schifffahrtskalender 1908 für das Elbe-Gebiet, Paul Grimm. Dresden.

# RIVERS AND CANALS IN THE AMERICAN CONSULAR DISTRICT OF BREMEN, GERMANY.

Report by WILLIAM THOMAS FEE, *Consul.*

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The territory of this consulate is traversed by the river Weser and its tributaries. It is a tide-water stream as far inland as the city of Bremen, and forms a connecting link with that city and the sea, a distance of some 42 miles, and has been made navigable for the ordinary seagoing craft up to 20 feet or more draft. The upper Weser is navigable for small river boats as far as the city of Cassel, about 200 miles to the southward.

## I. SUPERVISION.

The public supervision of the river Weser is under the jurisdiction of the States bordering its banks, namely, the Kingdom of Prussia, the Grand Duchy of Oldenburg, and the free State of Bremen.

The official duties of the Governments of these three States are, police supervision and maintenance and improvement of waterways, as provided by law.

The States do not control the river freight rates or traffic, which are entirely in the hands of private corporations and private persons.

The collection of statistics of water-borne traffic are compiled and published in Bremen by the Bremisches Statistisches Amt. To meet the expenses of this office a "declaration tax" is levied on the value of the freight shipped, either by rail or waterway, which amounts to 1 pfennig (0.238 cent) for each 66⅔ marks ($15.71). The shipper is compelled to sign a declaration giving the number of packages, the name of the goods, the country or place of origin, the net and gross weights or other measurement of goods, and the value of the goods.

## II. WATERWAY IMPROVEMENTS.

Hitherto there has not been any established policy as to water power developed by works constructed for improving navigation. At present, however, the State of Bremen is constructing a storage dam near the village of Hemelingen, about 5 kilometers east of Bremen, which will be provided with turbines. This plant when finished will have 16 turbines of 600 to 1,000 horsepower each; the maximum capacity will be from twelve to thirteen thousand horsepower. For the present only five turbines are planned to be finished, but the foundation and pillars for all 16 turbines will now be constructed. The turbines have vertical shafts, at the prolongation of which dynamo machines are posted. The power thus generated will

be used by the electric works of the city of Bremen. The dam itself will not be completed until the middle of next year; its construction is like that of the dam at Lockport, Ill. Besides the turbines, it will be equipped with a fishway and with two locks measuring 350 by 12.5 meters and 70 by 12.5 meters, respectively. The two chamber locks are separated from each other by a wall 7 meters in breadth and 10 meters in height. This wall contains two large hollow spaces, the lower one of which is constantly connected with the low-water level. The foundations of the heads of the locks are constructed out of beton and iron, strong enough to resist the heaviest pressure of the underground water.

The opening of the locks, and the closing, is done automatically by an ingenious device, which is called "System Nyholm," and which utilizes directly the fall of the river without the aid of power machines. A report on this system was sent to the Department of State on July 17, 1908. The total costs of construction of the dam and its equipments are calculated to be about 8,000,000 marks ($1,904,000).

The main object of building this dam is to raise the water level of the upper course of the river Weser, which had been lowered so much by the deepening of the navigable channel on the lower course of the river as to cause damage to the adjoining farming country. River navigation will naturally profit greatly by it.

All improvements of waterways are made by the State bordering the river, or by a combination of those States that are benefited by such improvement.

On the lower course of the river Weser, from the mouth of the river (Red Sand Lighthouse) to the free harbor at Bremen, a distance of 112.4 kilometers, the navigable channel has been deepened at an expense of 33,661,710 marks ($8,011,487), which was paid by the city of Bremen. By this improvement the following depths of the river bottom were established, the measures being given below Bremen zero, which lies 2.28 meters, or 7.48 feet, above the level of the North Sea:

At Bremen (free harbor), 4 kilometers from the Weser bridge, 6.5 meters Bremen zero, or 6.2 meters below average high tide, or 4.6 meters below average ebb tide.

At the town of Vegesack, 17.5 kilometers from the Weser bridge at Bremen, 7.2 meters Bremen zero, or 6.6 meters below average high tide, or 4.5 below average ebb tide.

At Farge, 26 kilometers distance from Bremen, 7.7 meters Bremen zero, or 7.1 meters below average flood tide, or 4.6 meters below average ebb tide.

At the mouth of the river Hunte, 32.5 kilometers from Bremen, 8.4 meters Bremen zero, or 7.8 meters below average flood tide, or 4.9 meters below average ebb tide.

At Brake, 40.6 kilometers from Bremen, 8.8 Bremen zero, or 8.2 meters below average flood tide, or 5.1 meters below average ebb tide.

At the mouth of the river Geeste, 65.5 kilometers from Bremen, 10 meters Bremen zero, or 9.3 meters below average flood tide, or 5.9 meters below average ebb tide.

The width of the navigable channel of the river Weser is as follows: Between Bremen (free harbor) and Vegesack, from 70 to 80 meters; between Vegesack and the mouth of the river Hunte, 100

meters; between the mouth of the river Hunte and Brake, 120 meters; between Brake and the mouth of the river Geeste, 140 to 150 meters.

The harbors for the large trans-Atlantic liners and other deep-sea craft are at Bremerhaven. They are:

| Name. | Date of construction. | Length. | Breadth. | Length of quays. |
|---|---|---|---|---|
| | | *Meters.* | *Meters.* | *Meters.* |
| Alter Hafen | 1827–1831<br>1860–1862 | 750 | 115 | 1,350 |
| Neuer Hafen | 1847–1871 | 830 | 114 | 1,520 |
| Alter Kaiserhafen | 1872–1876 | 600 | 145 | ..... |
| Vergrosserter Kaiserhafen | 1892–1897 | 800 | 285 | 2,160 |

On the west side of these quays are the railway tracks, and adjoining them is a paved street, while on the east side the quays are bordered by sheds, which again, on their opposite side, adjoin the railway tracks. There are two railway freight stations in the harbor district, one on the outside and the other one inside the territory of the customs union.

The "Alter Hafen" is equipped with three hand cranes of 2.5 and 7.5 tons capacity. The "Neuer Hafen" has two hand cranes of 8 and 12.5 tons capacity, respectively, one steam crane of 45 tons, one turnable steam crane of 75 tons, and two steam cranes (system Brown-Weson) of 1.5 tons capacity each. The "Alter Kaiserhafen" has one 20-ton hand crane, one 1.5 steam crane (Brown & Wesing), and one 30-ton turning crane. The "Neuer Kaiserhafen" has one 20-ton hydraulic crane and one 150-ton giant electric crane.

In Bremerhaven there are two dry docks. The one in the "Neuer Hafen," for vessels measuring 114.20 and 138.67 meters in length, belongs to the Norddeutscher Lloyd Steamship Company, and is surrounded by repair shops.

The Kaiser dry dock, for vessels of 228 meters length, was built by the State of Bremen in the years 1895–1899, and is rented to the Norddeutscher Lloyd Steamship Company.

Adjoining Bremerhaven is the harbor of Geestemünde, on Prussian territory, and on the opposite side of the river Weser are the piers of Nordenham, which can be approached by deep seagoing vessels. Nordenham is on Oldenburg territory, as is also the harbor of Brake, which is situated about 18 kilometers upstream, and which is also well provided with loading and unloading facilities especially suited for the grain trade. The city of Bremen proper has the following harbors:

(1) Lumber and factory harbor. Area, 17.297 acres; length, 1,170 meters; breadth on average, 8 meters; depth on north side, where the factories are situated, 6.3 meters, with ample railway connections and 2,100 meters of storing space; 2 hand cranes, 4 hydraulic cranes, 4 sheds and warehouses, and 3 grain elevators.

(2) Free harbor, Basin I. Length, 2 kilometers; breadth, 120 meters; 3,700 meters loading space, with railway tracks. The harbor is equipped with 87 hydraulic cranes of 1.5, 2.4, and 10 tons capacity, one floating crane of 40 tons capacity, one loading bridge, and 22

warehouses and sheds. The one-story sheds have about 74,000 square meters of floor space, the warehouses (of three and four stories) about 124,500 square meters. The loading and unloading of vessels is done by the Bremer Lagerhaus Gesellschaft (Bremen Storage Company).

(3) Free harbor, Basin II, is similar to Basin I. Length, 1,720 meters; breadth, 100 to 110 meters. Its fore harbor measures 350 by 240 meters, and allows vessels to turn. Adjoining this is a basin measuring 275 by 800 meters for intervessel loading and unloading.

The State of Bremen has now under construction a large and new harbor at Bremerhaven and a new factory harbor at Grambke, near Bremen, which, however, will not be completed for some years to come.

For inland navigation Bremen has the following accommodation:

Weserbahnhof. Quays directly on the river Weser, 491 meters in length, of which 451 meters are occupied by storage sheds. From this point most of the freight of the trans-Atlantic liners is shipped by barge to Bremerhaven.

Hohetorshafen. Situated on the opposite or left bank of the river Weser. The area of this harbor measures 60,000 square meters, and its depth is sufficient to allow vessels of 5 meters draft to lie afloat.

### III. FLOATING EQUIPMENT.

On the upper course of the river Weser stern-paddle-wheel steamers and barges are used for transportation of freight. Both are built of steel. The steamers measure 50 meters in length, 11 meters in breadth, and are equipped with engines of from 200 to 500 horsepower. Their speed is about 6 kilometers per hour. The barges measure 60 meters in length, 8.2 in breadth, and, when loaded, their draft is 1.8 meters.

The length of the tug train of boats is generally 450 meters. Statistics regarding the cost of construction of the various types of river boats are not obtainable.

### IV. OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

Oil from the Hanover district is shipped in tank barges. River boats and barges are not owned by the State nor by the railways.

The wages paid to boat hands on the upper Weser vary from 3 marks ($0.71) to 6 marks ($1.42) per day.

The navigation of the Weser is in the hands of the following stock companies:

Bremer Schleppschifffahrts-Gesellschaft—capital, M. 2,250,000 ($535,000).

Mindener Schleppschifffahrts-Gesellschaft—capital, M. 1,400,000 ($117,000).

Wesermuehlen Aktiengesellschaft—capital, M. 500,000 ($117,000).

Celler Schleppschifffahrts-Gesellschaft—capital, M. 700,000 ($166,600).

Several private persons—capital, M. 500,000 ($117,000).

There are no navigation taxes levied on the upper Weser, excepting on the Fulda Channel, from Münden to Cassel, a distance of 28 kilometers, where a tax is levied on the cargo.

Combined railway and waterway freight rates do not exist.

### V. TERMINAL FACILITIES.

The terminal facilities at Bremen are owned by the State, while in ports of the upper Weser such accommodations are established and maintained partly by the State, community, or by private persons.

### VI. TOLLS AND FREIGHT RATES. (Omitted.)

### VII. WATER-BORNE TRAFFIC.

The following table shows the ships' traffic on the upper Weser during the last 10 years:

| Year. | Arrivals. | | Departures. | |
|---|---|---|---|---|
| | Number of vessels. | Register tons. | Number of vessels. | Register tons. |
| 1899 | 1,611 | 292,526 | 1,528 | 282,465 |
| 1900 | 1,714 | 307,324 | 1,674 | 302,609 |
| 1901 | 1,751 | 316,467 | 1,690 | 312,882 |
| 1902 | 1,794 | 325,635 | 1,756 | 329,994 |
| 1903 | 2,136 | 396,397 | 2,065 | 391,817 |
| 1904 | 1,893 | 365,121 | 1,872 | 366,625 |
| 1905 | 2,150 | 481,847 | 2,119 | 481,666 |
| 1906 | 2,144 | 541,053 | 2,095 | 534,726 |
| 1907 | 2,353 | 675,688 | 2,357 | 684,599 |
| 1908 | 2,270 | 679,360 | 2,216 | 666,850 |

In the arrivals are included:

| Year. | Rafts. | Register tons. | Year. | Rafts. | Register tons. |
|---|---|---|---|---|---|
| 1899 | 181 | 2,345 | 1904 | 28 | 650 |
| 1900 | 117 | 2,106 | 1905 | 32 | 695 |
| 1901 | 53 | 1,463 | 1906 | 24 | 531 |
| 1902 | 62 | 1,661 | 1907 | 25 | 559 |
| 1903 | 57 | 1,325 | 1908 | 22 | 512 |

# RIVERS AND CANALS IN THE CONSULAR DISTRICT OF BARMEN.

Report by GEORGE EUGENE EAGER, *Consul.*

## I. PUBLIC SUPERVISION.

The supreme public authority over all undertakings in the improvement of rivers or building of canals is vested in the minister of public works, head of the bureau of public works at Berlin. Each great river is divided into sections, and over each section there is appointed a so-called "schiffahrts inspector" (shipping inspector), who has supervision of his particular division. Over the entire river a specially appointed commission superintends its working and improvement.

Inspectors have nothing to do with the capitalization of projects.

The rates are made by the local harbor directors, which are forwarded to the minister of public works for his revision and approval.

It is the same way with reports. Each inspector makes his report to the river commission, who in turn forward the combined reports of the inspectors to the bureau of public works, where they are finally completed and given out by the central government.

Improvements of channels, building docks and terminal facilities must all be planned first by those interests desiring to make them. These plans are then submitted to the commission, then to the bureau of public works, which either gives or refuses its consent to their construction.

The collection of statistics as to amount of fees collected and freight handled, etc., is done by each city that possesses a harbor, railroad, or wharf. These statistics are in turn sent to the ministerium in Berlin, where they are compiled and given out by the central government.

## II. WATERWAY IMPROVEMENTS.

All improvements for rivers and canals are made by the State. Harbors and terminals are usually undertaken by either cities or private corporations, which have to submit plans to be approved and passed by the minister of public works.

All improvements to rivers for navigation and all canal construction in this district have been carried on by the Prussian Government. Harbors and terminals, together with their railroad and docking facilities, have in nearly all cases been built by cities. There are, however, one or two cases where private corporations have built their own harbor and docks. There is one at Düsseldorf-Reissholz which was built by a private land improvement company, in order to attract industrial companies to the location.

### III. Floating Equipment.

For a history of the different types of vessels used on the Rhine and the canals, with specifications, illustrations, etc., see the book Führer durch die Ruhrhäfen (Guide through the Ruhr Harbors).

(1) For carrying freight.
(2) Steam, horse, and sail power are used.
(3) From 150 to 700 tons.
(4) Modern vessels are mostly of iron construction.
(5) See book referred to above.
(6) For carrying coal, grain, sand, gravel, etc., the towboat with barges are mostly used, while for piece freight the transportation is usually done by the specially built river and sea-going steamers.
(7) See Guide to Ruhr Harbors.
(8) The boats are built for a depth of from 6 to 8 feet. See Guide to Ruhr Harbors.

### IV. Ownership of Vessels and Business Organization.

(*a*) No.
(*b*) None.
(*c*) None whatever.
(*d*) No.
(*e*) None.

### V. Terminal Facilities.

(*c*) Railroad tracks are located on terminals of inland waterways. The railroads at terminals in the case of city harbors are usually owned and managed by the city and are constructed to connect all the different harbor basins and wharves with the incoming vessels and with the state system of railroads.

(*d*) Nearly all river and canal terminals are owned by the cities. None are owned by private railways.

### VI. Tolls and Freight Rates.

(*a*) The toll charges on canals are usually based upon the amount of capital invested, and are made as low as possible, so as to attract traffic.

(*b*) Different companies make rates to suit themselves, and different rates are made according to the kind and quality of freight.

(*c*) The Dortmund-Ems Canal have regular stable rates for different kinds of freight. River freighting companies make their own rates.

(*e*) No prorating arrangements exist between railroad and water lines, because the state railroads have charges fixed by the central government.

(*f*) There is no competition between the state railroad lines and the river and canal lines.

(*g*) There is no active competition between the state railroads and water lines, and no agreements for the division of traffic.

(*h*) There is no legislation regulating the relations between railways and inland waterways. Each harbor and terminal arranges

its own docking and loading fees and its own railroad transportation fees to the state railroads. These tariffs are submitted to the bureau of public works, and if they do not work an injustice to some neighboring harbor or terminal are approved and allowed.

The railroads are not responsible for loss or damage to freight by transportation. The owner must insure his goods, or stand the loss by wreck or fire, himself.

This does not affect the freight rate.

## VII. Water-Borne Traffic.

(*a*) Incoming water-borne freight consists mostly of raw materials.

(*c*) The predominence of local water traffic over other traffic depends upon the amount of manufacturing and producing of the place in question.

(*d*) Labor conditions in all the harbors and terminals are about the same as at Neuss Harbor, described on page 116.

Conditions as to water and railroad traffic here in Germany are quite different from those in the United States, on account of the fact that every project of the kind is under complete control of the Government. No private railway or waterway can be built without the entire plans and specifications being submitted to the minister of public works, and if these plans are not approved and accepted the work may not be allowed. An illustration may be had in the following: Not long since the city of Düsseldorf asked permission of the Government to build a rapid-transit electric road between this city and München-Gladbach. It was not granted because the Government argued that there was a State railroad between the two cities, and they preferred to have a road already at hand pay rather than to allow another built that would injure the present one. The same city asked permission to build a similar road to the neighboring city of Cologne that should make a short cut and allow passengers to make the trip in 15 minutes. This was at first also refused, but a second effort has been made to prevail upon the authorities to grant the permission, but the matter is still pending.

In addition to the above answers to the circular of August 19, I desire to submit, as a part of this report, separate reports upon the Dortmund-Ems Canal and the several important inland harbors in this district.

## The Dortmund and Ems Canal.

### RETROSPECT.

The Dortmund-Ems Canal owes its origin to efforts continuously made since the middle of last century to connect the industrial centers of Rhineland and Westphalia by means of a waterway with eastern Prussia. The canal as it is to-day forms a part of the greater waterway which in the near future is destined to connect the river Rhine with the city of Hanover. From one of its extremes at Herne the canal is to be continued so as to form a junction with the Rhine, and from Bevergen, the other end, another extension will be

dug which will reach Hanover. As long as the Rhine and Elbe remain unconnected the Dortmund-Ems Canal by way of Emden and the North Sea forms the natural outlet for this part of Germany in its commercial relations with the outer world. Such a connection is of vast importance on account of the steadily increasing traffic of this very important industrial region. Up to the present time the railroads, in their present state of development, have been able to cope with the constantly growing freight movement, but it is extremely doubtful whether they will be able to continue to do so in the future. The area in question is a narrow strip of land between the rivers Lippe and Ruhr, extending from the Rhine to the city of Unna, and covers about 1,390 square miles. Within its limits there are 200 collieries at work, having a yearly production of 80,500,000 tons and employing 303,000 men. Assuming that shafts are sunk to a depth of 2,300 feet, there is an ample supply of coal for the next two hundred years, even allowing a considerable increase in the output, and by sinking the shaft to 3,200 feet there is enough supply for three hundred years. There are also 120 iron works in this area.

### ROUTE OF THE DORTMUND-EMS CANAL.

The law sanctioning the construction of this canal was passed July 9, 1886. It fixed the starting point at the city of Dortmund, thence to Münster, Bevergen, and Papenburg. Beyond the latter place the canal follows the lower Ems, and from Oldersum a lateral canal leads to Emden, completing the route. The distance from Dortmund to Emden via canal is 168 miles. The object of the lateral canal was to avoid the widening estuary of the Ems above Emden, where navigation for canal boats is unsafe. There is also a branch canal which connects Herne with the main canal at Henrichenburg, and is 7 miles in length.

The summit level of the canal at Dortmund is 230 feet above zero at Emden. The first section is 9½ miles to the ship elevator at Henrichenburg, which makes connection with the main canal and lower the boats 46 feet, or 184 feet above zero. The second section, from Herne to Münster, is 41⅔ miles long. At the latter place there is a lock with a fall of 20⅓ feet, which connects with the so-called "Midland reach," which extends from Münster to Bevergen, a distance of 23 miles. This level is 164 feet above zero and it is from the end of this section that the proposed canal to Hanover and eventually to the river Elbe will be built. This new extension, when finished, will connect Münster with Hanover, a distance of 130½ miles, without a single lock. From the Midland section the canal descends to the Ems by locks, with falls varying from 11 to 13½ feet, the last lock leading into the river at Gleesen; it has a fall of 20⅓ feet and is built with side basins, the same as the locks at Münster. Up to this point all locks have an available length of 220 feet, the entrances are 28½ feet wide, and the depth of water on the sill is 10 feet.

Beyond the Gleesen locks the canal follows the river Ems for about a mile, where by means of a regulating lock it enters the former Haneken Canal. Below this junction all locks in the canal and in the canalized Ems have a length of 541⅓ feet and an entrance width

of 33 feet. There are four locks on the Haneken Canal and five open on the Ems between Meppen and Herbrum, 133½ miles from Dortmund. Below Herbrum to Emden there is a sufficient width and depth in the river to accommodate canal-boat traffic, and here the open Ems is utilized for a distance of 28 miles.

In order to descend from the summit level to the main section of the canal it was at first planned to establish a series of locks following the fall of the Emscher Valley; but this idea had to be abandoned on account of not having a sufficient supply of water available at the highest point for locking. The water of the Emscher could not be used, as it was too foul, being polluted by the sewage of Dortmund and by the water pumped into it from numerous coal mines.

The canal crosses the watershed between the Emscher and the Lippe Valleys in a cut 33 feet deep to canal bottom, across the Lippe Valley on a raised embankment, with towpath that is 44½ feet above the ground level. The river Lippe is crossed on a stone aqueduct having three spans of 69 feet each. Crossing the watershed of the Lippe and Stever Valleys necessitated a cut 39½ feet deep, and the embankment that crosses the Stever Valley is of the same height. The river Stever is crossed by another aqueduct, having three spans of 41 feet each, situated 1⅓ miles below Münster; the river Ems is crossed on a massive aqueduct having four spans of 41⅓ feet each. The canal has to overcome the greatest difference in levels within the drainage area of the Ems at a point near Riesenbeck, where it passes through a cut 41 feet deep. Beyond the lock at Bergeshoevde the country descends rapidly, so that the sections, from lock to lock, do not exceed more than 5½ miles in length. Such short reaches between locks, however, are not to be recommended. In the present example, the headway from the water to the soffit of a bridge crossing over the canal has been fixed 13⅓ feet, but it is intended to increase to 15 feet. The water level above the regulating gates on the Haneken Canal is kept down by a massive overflow weir giving free fall.

In the upper four reaches of the Ems, between Meppen and Herbrum, the water is dammed by needle weirs. At Herbrum sluices were considered necessary, as under certain conditions the water below the sluices can rise to a greater height than below. There are in all 20 locks in the canal.

### DIMENSIONS OF CANAL.

The canal has a depth of 8 feet 2½ inches, and the width of the canal at the bottom is 59½ feet. Dimensions fixed for future Prussian canals are not essentially different. The area of the standard wet cross section is 639¼ square feet.

### EARTHWORKS AND PROTECTING SLOPES.

Originally it was not thought necessary to face the slopes throughout, but during the course of construction it was discovered that the material for forming the slopes was in most cases of a sandy nature, and not compact enough to resist the wash of passing vessels.

## CANAL ELEVATOR, LOCKS AND BRIDGES, ETC.

It is not proposed to give a minute description of the various structures along the entire canal, but will suffice to allude briefly to some of them that are novel in construction. Any person desiring more detailed information is referred to a series of articles published in the Zeitschrift für Bauwesen, Ernst & Korn, Berlin.

### CANAL ELEVATOR.

The most important structure on the canal is unquestionably the elevator at Henrichenburg, which serves to overcome a fall of 36 feet between the Dortmund and main sections, capable of accommodating vessels to 950 tons, having a length of 220 feet, 27 feet beam, and a draft of 6 feet 7 inches. All previously constructed elevators for similar purposes were of much smaller dimensions. The oldest structure of this kind is the Anderlon elevator for raising vessels of 150 tons and that of La Louviere, completed several years ago, for 360-ton boats. The system of construction chosen may be described briefly as a floating lift. The substructure consists of five contiguous wells, each 30 feet 2 inches in diameter and 98½ feet deep. No difficulty was found in sinking these wells to this great depth, as hard marl of great depth was fortunately found at this point with very few fissures. In each well floats a hollow cylinder or buoy 27¼ feet in diameter and 32⅝ feet high.

Each float, when immersed entirely under water, has a lifting power of 620 tons, so that the five cylinders together exert an upward pressure of 3,100 tons, which is equivalent to the weight of the trough, when full of water, plus the weight of the five vertical supports upon which it rests. The trough is suspended by five vertical bands in a kind of cradle, which in its turn rests on the five lattice-work supports carried by the floating hollow cylinders. The whole construction, including hollow cylinders, vertical supports, and the tank or trough filled with water, are in perfect equilibrium, so that if any extra water is admitted the trough begins to sink, or if any water is abstracted, the trough begins to rise. In order to control the movement both up and down, to start the lift at the proper moment, to stop it at any time, or to check the momentum at the end of rise or fall, and to hold the cylinders true, four massive vertical spindles are turned by shafting acting on all four spindles simultaneously, causing them to revolve at a uniform speed. Both ends of the trough and both fixed shore ends of the canal are fitted with water-tight gates.

The time occupied in raising one barge and lowering another averages twenty-five minutes. The actual time of raising or lowering the elevator trough is two and one-half minutes. The gates can only be lifted if the trough is in the exact position, otherwise the gear is locked. Neither can the trough be moved unless the gates are closed. The ends of the gates are beveled to form a joint with similar surfaces at the level. These surfaces form a frame round the trough and the level being rubber jointed they make a water-tight connection of the trough to the level as soon as the oblique ends of the trough, in its ascent or descent, coincide with the oblique ends of the level. The oblique surfaces of the canal level are fitted to a movable frame,

which can be adjusted according to the height of the water levels. Inside the frame between the two water gates there is a small space, which before the gates are lifted can be filled with water through a sluice valve in the gate of the level. On lifting the gates the same water pressure exists on both sides and the gates can be easily lifted, as their weight is for the most part balanced by counterweights.

Screw spindles 80 feet in length and having an outside diameter of 11 inches are driven by an electric motor, as are the other movements of the elevator, such as the lifting devices for the lift gates at the divisions of the trough levels and the capstan for working the vessels in and out of the trough. The electric power is supplied from a special power plant erected adjacent to the elevator.

### OPERATION OF THE ELEVATOR.

The operation of a transfer is as follows: If, for example, the vessel is to be transferred from the higher to the lower level, the first operation is to effect by a crank the unbarring and the uncoupling of the gates, also the filling of the space between the two gates inside the frame between the trough and the level. Then, by moving a handwheel, the motor of the guard is started and the gates are lifted 22.9 feet.

The bottoms of the gates are raised 16½ feet above the water. The vessel may now enter the trough. If the vessel is not self-propelled, the capstan rope is passed to the vessel and the entry completed. The gates are lowered by a slight turn of the handwheel, after which the doors are uncoupled by means of the crank movement, the level door unbarred and the sluice door closed. These operations are easily executed by two crank movements, and require only one attendant for each of the capstans. The capstan ropes are secured and released by the crew of the vessel. The attendant will then proceed to the trough and the guard attendant gives the starting signal to the attendant of the spindle motor, who by a simple lever movement starts the trough.

The trough then descends by the spindle gear toward the lower level, where it is pressed by the gear against the jointing, while the movement of the spindle automatically ceases at the same time the unbarring of the gates commences. The attendant, who has descended with the trough, has in the meantime proceeded to the other end of same, and from there goes to the lower level, which has now been reached, and carries out with the hand cranks the same operation as at the upper level. The gates are unbarred, coupled and lifted, and the ship steams out of the trough, or is hauled out by the capstan.

A second vessel can then enter the trough, the gates are shut, the trough ascends to the higher level and so on. If the vessel is self-propelled, it enters with its own power, which saves considerable time. A passenger steamer, for instance, can be transferred from one level to the other in from four to five minutes. It has at the same time performed from 500 to 650 feet of its journey. In the case of the heaviest vessels, not self-propelled, which have to be hauled in and out by the capstan, about twelve minutes are required for the transfer from one level to the other.

The elevator has thus far worked without any hitch. It even behaved extremely well on one occasion when, by accident, the trough

ran dry during a downward journey, and the apparatus had to act under conditions for which it was never intended. Experiments made with the elevator have given very favorable satisfaction. In twenty-one working days of eight to ten hours each it was possible to effect 600 single transfers. Fifty successive double transfers required no more than twenty-four minutes each, in which time one transfer up and one down were made.

The total cost of the immense undertaking was about 2,500,000 marks ($595,000), a relatively low price. The working expenses for a transfer amount on an average to about 2 to 3 marks. This elevator which has alone overcome the whole difficulty of the higher level, has worked without interruption or breakdown since 1899. It was built by the firm of Haniel & Lueg, of Düsseldorf, Germany.

The great aqueducts upon which the canal is carried across the Lippe, Stever, and Ems, are constructed entirely of masonry, forming noble-looking structures, which are well worthy of being studied by engineers in detail.

### BRIDGES.

There are 185 bridges that cross the channels. Two of these are swing bridges and the others are fixed girder bridges, giving a headway of nearly 16 feet above the highest navigable water level. The square span of the bridges was fixed at 101¾ feet, in consequence of which the cross section of the canal is contracted at the bridges. In the long run it was found preferable to increase the spans of the bridges sufficiently so as not to contract at all the cross section of the canal.

### LOCKS.

Among these, two deserve particular attention, namely, those at Münster and Gleesen, each with a fall of 20 feet 4 inches. Both locks have side reservoirs, in order to economize the water required for locking and to keep this quantity down approximately in proportion to that required for working all the other locks, regardless of their higher falls. The filling and emptying of the locks is effected by culverts, one on either side, formed in the side walls of the lock and each having a sectional area of 38¾ square feet. Each culvert is connected with the lock chamber by seven pipes. Communication between the side reservoirs and culvert is made by cylindrical valves of 6 feet diameter. The connection between the culvert and the high or low-level reach can be shut off by sluice gates working on rollers. The average time required for passing a barge through a short lock is sixteen minutes. On an average, about thirty minutes are required to pass a train of barges through one of the long locks, including in both cases the time taken in getting in and out of the lock.

### WEIRS AND SLUICES.

In the canalized Ems the water is held up in four deep-water reaches by needle weirs. At Herbrum there is a set of six sluices of 28 feet span each. These are necessary owing to the need of making provision for shutting out the water in the lower reach, which occasionally rises higher than the water level in the upper reach. The sluices work on rows of rollers in a manner similar to that adopted on the Manchester Ship Canal.

### STOP GATES.

For the purpose of dividing the canal into isolated reaches, stop gates of an entirely novel construction have been adopted. It was considered necessary to introduce such gates, because every embankment of any great height, leading through a valley, forms a constant source of danger. Each stop gate is closed by an attendant who lives on the spot and whose business is to close the gate immediately on receiving a warning signal.

### WATER SUPPLY FOR THE CANAL.

In calculating the quantity of water required for feeding the canal, it was assumed that the loss of water through evaporation and percolation would amount to 2.83 gallons per second per mile. At the outset, after the canal had been open for traffic, this loss was found to be 3.68 gallons, or 343 gallons for every 93½ miles of canal. To this quantity had to be added the amount lost through locking at the end of the lock. The total amount thus required for replenishing the canal is supplied by a pumping station on the banks of the river Lippe, where the feed water has to be raised to a height of 51½ feet. At the present time there are four centrifugal pumps driven by steam power, each pump being capable of raising 194 gallons per second. Each pump is driven by a 400-horsepower engine. Besides the water supplied by pumps, the canal is also fed by natural water courses. The summit reach is fed from the main reach by two pumps, each of which can raise 55.3 gallons per second. On an average during the summer months, the water lost from the canal through evaporation and percolation amounts to a depth of 1.063 inches daily. The greatest total loss by evaporation amounts to 8⅘ inches during the month of August; that is, three-tenths of an inch per day.

### CANAL PORTS.

There are several ports and many wharves along the canal for the interchange of traffic. Large harbors are situated at Dortmund and at Emden. The wharves are formed by widening out the canal on one side of the points in question by about 33 feet for one or more ship lengths.

### COST.

The work was begun in 1893, and on the 11th of August the canal was opened for business by the German Emperor.

| | |
|---|---|
| Purchase of land | $1,951,600 |
| Earthworks and slopes | 5,569,200 |
| Locks, bridges, etc | 5,426,400 |
| Subsidiary works, ports, etc | 1,261,400 |
| Reservoirs, pumps, etc | 261,800 |
| Engineering, etc | 1,618,400 |
| General expenses and unforeseen contingencies | 2,499,000 |
| Maintenance during construction | 309,400 |
| Total | 18,897,200 |

The above sum is the cost for 156¾ miles, or about $121,662 per mile.

The entire canal with its appurtenances was built at the expense of the State of Prussia.

### Dortmund Harbor.

Ground was broken for the Dortmund Harbor on the 9th of October, 1895, with appropriate ceremonies, and the harbor was finished and opened for business by the German Emperor at the same time as the Dortmund-Ems Canal—August 11, 1899.

The Dortmund Harbor was built by the city of Dortmund, and, as it stands, cost about 8,250,000 marks ($1,963,500). The State assisted the city with a loan of 1,325,000 marks ($317,000), on which interest must be paid, but which is redeemable by the city at any time; 1,100,000 marks ($261,800) were paid out for land for the harbor basins, quays, storage, and warehouses and railroads, which cover about 300 acres, and there remains as much more for extension and building.

Ten years have passed since the opening of the original harbor. To the original canal harbor, which lies at the beginning of the canal, an extension has been added, making the basin about 1 kilometer (0.62137 mile) in length. To this has also been added three large basins 60 meters (196 feet) wide and from 360 to 500 meters (1,181 to 1,640 feet) long, and also a petroleum harbor near by, which is separated from the rest of the harbor by a floating barrier contrivance, which prevents the spread of burning petroleum over the whole harbor in case of fire.

The total length of the available wharfage on the harbor basins is nearly 6 kilometers (3.72822 miles), and the entire harbor basins are surrounded with a vertical stone quay, composed mostly of basaltic blocks, which forms a durable and excellent wharf. A new basin is in course of construction which will have a length of 400 meters (1,312 feet). This, in connection with the old town harbor, is intended especially to accommodate shipping companies, forwarding agents, and others interested in the development of harbor traffic.

The entire harbor basins and wharves are connected by the city railroad with the harbor railroad station, which is a regular tariff station of the State railroads. Storage warehouses have been built for the convenience of the canals and railways, supplied with water, drainage, and electricity for power and light. These may be rented at moderate prices. The city also leases ground with hereditary rights of building and re-leasing, which gives practically perpetual rights. Two wide iron bridges lead across the harbor basins from the city, avoiding a wide detour. A swing bridge for passenger traffic is also being built across the new harbor basin. A passenger waiting room has also been provided for the swing bridge.

The city has erected convenient, modern appliances for loading and unloading freight of all kinds. In front of the three large city warehouses are four electric-power portal cranes for removing freight from ships to storehouse or to railway wagons, or vice versa, and there is also a large steam-power crane for handling coal, ore, etc. A hydraulic tilter is also supplied, whereby from 10 to 12 tons of coal per hour can be tilted into the barges.

One of the storehouses is utilized as a customhouse and bonded warehouse, where goods may be stored free of duty until removed.

For the storage of grain, a large elevator has been built. It is six stories high and is provided with an apparatus for handling grain by which 77,161 pounds of any kind of grain may be taken from or loaded into ships and placed on any floor of the elevator. At the same time it frees the grain from all particles of dust or dirt, weighs it, and, if necessary, places it in sacks, trucks, or carts. By the same mechanism it is also possible to move the grain to the different floors of the elevator or where otherwise required. Electric power for lighting, supplying the electric current for motors, cranes, etc., is supplied from the city electric works. The supply cable connecting the works with the harbor is about 2 miles long. From here the current is distributed throughout the harbor, and at the same time reduced from high to low tension. The current is transformed from 1,200 volts to 3,200 volts. Cables or wires for the fire alarm and for electric clocks are laid together with the electric high-tension cable.

The water supply for the harbor comes from the city waterworks and is piped in water mains throughout the entire harbor, which, together with an ample supply of hydrants, offers efficient protection from fire. Connection has also been made with the harbor and city systems of sewerage, affording perfect drainage for the harbor and its buildings.

The adjoining country north and west as well as that part of Westphalia to the south and east forms a very busy industrial neighborhood from which traffic is drawn. This territory extends as far west as Gelsenkirchen and Essen, southerly to Grevenbroich, and westerly to Lippstadt and Warstein. There is no doubt that in future the effect of the cheap traffic way offered in the Dortmund-Ems Canal will make itself felt and this zone will be continually extended into the interior, especially toward the south, the more the harbor at Emden is visited by ocean steamship lines. Formerly this territory has been served by Hamburg and Bremen on the one side, and by Rotterdam and Antwerp, via the Rhine and railroads, on the other. The constantly increasing traffic for the past seven years assures a healthy increase for the future. The chief articles of export from the surrounding country are coal, coke, briquets, iron rails, and sleepers, from the immediate coal and iron industries, and towns farther inland send various products of the small-iron, metal, glass, and other industries. Axes, shovels, forks, anvils, vices, axles, glass, paper, and copper and bronze wire are dispatched over the Dortmund-Ems Canal to Hamburg and other eastern ports for exportation.

The receipts are grain, meal, sugar, iron and other ores, wood, sand, and gravel, and for the inland trade, corn, oils, fats, spirits and other necessities.

More and more the fact is becoming known that this route offers a material saving in forwarding freight as compared with previous railroad rates. It is estimated that 1 mark ($0.238) per ton is saved on ordinary materials, and on piece goods the saving is very much greater. The freight on 100 kilograms (220 pounds) from Dortmund to Hamburg by rail is 2.48 marks ($0.60) and by canal it is only 95

pfennigs (23 cents). From Dortmund to Stettin the rate on the same goods is 5.02 marks ($1.19) and by canal it is 1.30 marks (31 cents). To Danzig and Königsberg the rates by rail are 7.25 and 8.09 marks ($1.72 and $1.92), respectively, while the rates by canal remain the same as from Dortmund to Stettin. With such a great difference in the freight rates the small charges for loading and unloading from rail to ship and vice versa of about a cent per 220 pounds plays no part. By the collective forwarding of piece goods from place to place of course the difference in rates would not be as much, but it is safe to say that by use of the waterway one-half of the railway charges may be saved. For certain goods, such as coal, iron, steel, cotton, resin, dyers' woods, petroleum, linseed, maize, oats and various raw materials, the railroads offer low rates, but for goods of this description the canal offers exceptionally low charges, especially if it is a question of regular arrivals and large quantities.

From Dortmund to Emden regular weekly sailings have been established in order to promote quick dispatch. To Emden the time necessary is about three days, which is just as quick as by rail. To Hamburg it takes from five to six days, and to Danzig, Stettin, and Königsberg from four to ten days is required. This service connects at Emden with steamers of the Neptune Steamship Line for the north and east sea harbors. These in turn deliver freight inland to the canal boats, which distribute along the canal ports and to the Dortmund terminal. There are also many seagoing canal craft and lighters, which collect all local freight for the north and eastern ports, and return, bringing large quantities of pyrites and other raw materials destined for the interior. The shipping is principally controlled by the Westphalian Transport Company (Limited), but there are besides a large number of Dutch sailing boats, "Tjalken," which accept freight from Dortmund and all along the canal for all the seaports on the north and east seas. Other new companies are being formed to cover even a more extended field.

The great saving in freight is sure to attract additional traffic to this waterway to such an extent that its future importance is assured. It is not only of immense benefit to the immediate territory, but is beginning to be an outlet for the interior. For these and other reasons it is proposed to connect in the near future the canal with the Rhine and the Weser.

In order to offer better connections to the industries lying to the southwest, the city is building a railway line to Hörde, which will bring the great iron works, Höch and Hörder Verein (society), in direct communication with the harbor, and increasing thereby the railroad facilities.

It is true that this new undertaking will require an outlay of from 4,000,000 to 5,000,000 marks ($952,000 to $990,000), but the city of Dortmund fully believes that the millions spent in the interests of traffic will bring its full reward in time.

For further particulars as to the original history of the harbor, its building and completion, reference may be had to an illustrated volume entitled "Harbor of Dortmund," by Regierungs und Baurath Mathies, published in 1899.

For the development of the harbor from the time of opening to the present year; for extensions and improvements; for buildings and bridges, wharves, cranes, etc., giving plans and illustrations; for

the building of the city railway for the harbor and its environs; its railroad stations and connections; for a list of the firms situated on the harbor and in the vicinity; and for all statistics in regard to the costs, development, and increase, covering the amounts and kinds of freight handled from year to year, reference to a smaller book on the Dortmund Harbor, written and published this present year, by George H. Schmidt, is respectfully suggested.

### The Duisburg-Ruhrort Harbor.

The combined harbors of Duisburg and Ruhrort form what is probably the largest and most important artificial-basin harbor in the world. It is situated at the junction of the river Ruhr and the Rhine, in the northwestern part of Rheinish Prussia.

The river Ruhr was made navigable for small barges by the building of 16 locks, which were finished in 1780. By means of this route it was made possible to transport the products of the rich coal beds of Westphalia to the Rhine, and thence to upper Rhine cities, and also down the Rhine to the seaports. The income from locking fees and storage of coal at Ruhrort was set aside as a separate fund, and from this fund the entire Ruhrort Harbor has been built, which is a good example of the fact that it is possible to make the transportation improvements of a stream pay for themselves out of their own income. Ships bringing coal from Westphalian mines were obliged to unload or transfer their cargoes at Ruhrort, and it was therefore necessary to build dikes above the flood mark for the storage and handling of the coal, and from this beginning new basins have, from time to time, been added, which may best be studied in the different maps in a book entitled "Die Duisburg—Ruhrorter Häfen," beginning on page 20, which shows the development from 1753 to 1890.

Duisburg is one of Germany's oldest cities, although not of Roman origin. Already, in the twelfth century, it had become a trade center of importance, and semiannual "markets" (messen) were held since the year 1173. Duisburg at this time was directly on the Rhine, and her ships traded as far up the Rhine as Strassburg, and down the river to Rotterdam, and as far as London. In 1270 the river Rhine changed its course and Duisburg found itself separated by a distance of a mile and a quarter from the river. This proved a great setback to the development of transportation, for in the old channel only very small flatboats could be floated, and it was necessary to move the loading place for vessels from the Rhine to the lowest stretch of the Ruhr. Later the custom-house was also built at this place. The Duisburg Harbor was begun by a company called the Rhine Canal Company (Limited). This company built a canal from the Rhine to the city, which again brought back direct communication with the river. This work was begun in 1828, and three years later the first ship arrived from the Rhine and anchored before the head custom-house. In the course of a year or two practically all the former traffic was regained.

Shortly after this canal was finished and in working order another company was formed, called the Ruhr Canal Company (Limited), to connect the Rhine Canal with the river Ruhr. This work was begun in 1840 and finished in 1844. Two locks were necessary, and an agreement was made between the two companies whereby free

passage was granted to vessels of the new company through the Rhine Canal on payment of one-fourth of the earnings to the new company. Through the development of the railroads and the rivalry of Ruhrort Harbor with its more convenient connections, the incomes of these companies suffered so that they finally combined under the name of the Rhein-Ruhr Canal Company. Later important connections were made with railroad lines, but the income was still insufficient to meet obligations and pay expenses. The city, however, loaned money for improving the locks and widening the old Rhine Canal, and at the same time connection was made between the outer harbor and the Bergisch-Märkische Railroad. From this time on business increased so rapidly that not only was it possible to pay all expenses, but the income was sufficient to make many needed improvements. During the following years continual improvements were made. In 1889 the harbor came into possession of the city of Duisburg. In 1892 the inner harbor was extensively widened, and in 1895 to 1898 the new parallel harbor was built, together with a special entrance from the Rhine. The harbor now had a wharfage length of 6.83 miles, a water surface of 104¾ acres, and wharfage and building space of 445 acres. The total cost for the harbor to the city was 13,000,000 marks ($3,094,000). The Ruhrort Harbor, together with its railroad connections, belongs to the State, and both this harbor and the Duisburg Harbor prospered, and nearly all available space for industries was taken. In 1905 it was considered best for the continued success of both harbors that they combine their interests, and as it was impossible for the Ruhrort Harbor to take over the Duisburg Harbor and assume its obligations, it was decided to give the entire management of both harbors into the hands of a special board of managers, whose duty is to administrate both properties. This administration is to collect all rentals, fees for harbors and canal, together with the harbor railroad system and the disposition of the property held by both properties. Ten per cent of the income is to be reserved for improvements and a reserve fund not to exceed 5,000,000 marks ($1,190,000); then, after all expenses are paid, the net profits are to be divided between the Ruhrort Harbor Company and the city of Duisburg. This arrangement is to continue until the Duisburg Harbor debt is paid, when it will become optional for the Ruhrort Company to buy the Duisburg Harbor at a fair value.

Both Ruhrort and Duisburg are on the same banks of the Rhine, separated by the river Ruhr but connected by the new so-called Kaiserbridge, which is one of the finest works of its kind in Germany.

For the history of these combined harbors, together with the plans, maps, and specifications of all the buildings, bridges, locks, mechanism for loading and handling freight, together with statistics as to costs of construction, increase of traffic, and amounts of classified freight handled, reference is suggested to two books entitled "The Duisburg-Ruhorter Häfen" and "Guide through the Ruhr Harbors."

### Neuss Harbor.

Neuss, during the German-Roman period, owing to its convenient situation on one of the Roman roads that connected what is now Belgium and the river Maas with the Rhine, and as one of the principal Rhine crossings, was an important trading point.

In the eleventh century Neuss as one of the principal cities under the Archbishop of Cologne, was granted special privileges for trade, and in 1190 the cities of Cologne and Neuss were freed from paying the Rhine duties at Kaiserwerth, which shows that even at that time Neuss had reached an important point as a trade center.

The river Erft made a navigable connection with the Rhine to the north and the Rhine arm connected to the south. In 1195 this north connection began to fill in with sand and gradually receded, so that by the middle of the fourteenth century it was impossible for large vessels to reach the city. Therefore it was necessary to remove the landing place farther and farther until, in the year 1372, the Archbishop of Cologne removed the principal customhouse to the old town of Zons. The old channel had by this time become only a small arm, which for transportation purposes was of no value.

Notwithstanding this great setback, the clever tradesmen of the city continued to improve their trade for another century. Later came the storms of war, epidemics, and fire, and in the last half of the fifteenth century the city withstood a siege of 11 months in the Burgundian War under Charles the Bold. Afterwards came the terrible Thirty Years' war, which decimated every place in the land, and in 1576, on the 1st of May, a greater part of the city was destroyed by fire. Eleven years later came a pestilence which nearly wiped out the entire population.

From 1627 the regular ship traffic between Cologne and Neuss and other harbors was so badly affected by war, etc., that the freight rates were necessarily raised, until they were a great detriment to trade.

A new awakening came after the French Revolution, and the abolishing of many of the old so-called Rheinzölle (Rhine duties) had a beneficial effect, but new fees were added, and it was not for many years after that these burdensome tributes were annulled. The abolition of these taxes was made by Napoleon. He also proposed a canal that should connect the river Meuse with the Rhine, and should pass through Neuss, thus giving the city a direct communication with Viersen, Venlo, the river Maas to the river Scheldt, and Antwerp. Work was begun on this canal in 1808, but after working for two years and spending about $800,000, on account of Holland having been taken into the French Empire, it was no longer considered necessary, and was abolished in 1810.

After the fall of Napoleon and the return of Rhineland under Prussian rule in 1815, another effort was made to make a navigable connection with the Rhine. After much discussion it was finally decided to utilize the old stream—the Erft—for the project, and in 1818 permission for building was granted. The lack of capital and the difficulty of raising the same delayed the building until 1837, when, after two years, the Erft River bed was widened and made deep enough to accommodate large vessels to the city. The hopes of regaining its former importance as a trade center were soon realized, and shipping increased rapidly. In 1886 connection was made with the state railroads, the better to accommodate and connect the interior with the canal. With the development of shipbuilding and the introduction of steam power and the consequent increase in the size of vessels, it was imperative that the canal should be enlarged and

made deeper to accommodate the increased draft of vessels. This work was done as soon as possible and the canal was given a width at the bottom of from 65 to 82 feet. A turning basin was dug in one part of the canal by widening it to about 400 feet, so that together with the mean low depth of 8 feet 4 inches it was not only possible to accommodate the largest Rhine steamers, but also the Rhine ocean-going steamers. The immense amount of earth so removed was utilized to fill in the right bank of the canal and for filling the wharf space along the canal, at the same time giving protection against inundation in time of floods. At the mouth of the canal, where it enters the Rhine, the canal has a width of 131 feet.

Ten years later, in 1893, it was decided to increase the harbor by building a great harbor basin which could be extended to the southern part of the city, thereby greatly adding to the wharf and building space. At the same time the city decided to open up a large tract of land for the building of factories, warehouses, etc., that should be attracted by the excellent facilities for loading and unloading goods and the low rates of water transportation. At the same time plans were made for the building of a narrow-gauge railroad that should connect all new wharf and building space with the state railroads. In 1908 this great work was finished, and on June 17 of that year it was formally opened for use. The new basin is 2,400 feet in length and has a width at the bottom of 164 feet and the same depth as the canal. The sloping walls to the Erft Canal and the old harbor are 7.7 meters (25 feet) high. This is not quite high enough to resist high water, but it makes an excellent unloading place for small vessels and avoids high lifting of the freight. The new harbor and its wharves and building space are well over the high-water mark and quite safe from being flooded. The banks are protected by a stone wall 36 feet high. On the city side of the canal the stone wall has a foundation of cement to withstand the extra traffic, as this side is reserved as a permanent wharf for unloading and loading. As the business increases new parallel basins will be built, one of which is already in process of construction.

At the same time that the new harbor basin was being dug the city erected on the city side of the harbor a new storage warehouse. The old harbor was enlarged 82 feet in width as far as the turning basin, thereby giving space for the warehouse and for other freight forwarding companies. On the opposite side much new space for building was made available, and at the same time connected with the harbor railroad. Many new industries have bought land on this new ground, and among them are the International Harvester Company and the American Radiator Company, both branch factories of the great Chicago firms of the same name. The former has taken about 25 acres and the latter 14 acres. The sale of land for these two companies so encouraged the administration that they immediately commenced a new parallel basin which should form adequate wharfage and loading and unloading facilities for these new ventures.

The harvester company is situated on a promontory which has canal accommodations on three sides. In the case of the radiator company, the new canal was necessary in order to give it direct canal communication. Both firms are in process of erecting the necessary buildings for their respective plants. The harvester company com-

menced building in April, 1909, and it expects to have the works in operation in February, 1910. It may be of special interest to know that agents of the International Harvester Company made a tour of the entire waterways of Germany, finally deciding that the Neuss Harbor offered superior advantages to all others. Many of the harbors only rent space for building purposes, while at Neuss ground can be either purchased outright or rented on lease for usually fifteen years. Leases are made upon a 4 per cent basis of the value of the land, with an option of releasing at the end of the term at a revaluation. Not only is the Neuss Harbor convenient to the railroad centers of Europe, but it is on the most important waterway in the Empire and in direct connection with the great seaports of Germany, Belgium, Holland, England, Sweden, Norway, Denmark and Russia. They are building their own cranes for handling their raw materials and products, and all machinery, etc., is brought in the original packing right to their door. They will also have the advantage of the lowest rate of freight to all points for their manufactured products. It is expected that they will soon have to employ a force of 600 workmen. It is proposed to introduce American machinery and to reproduce the harvester machines exactly as they are manufactured in the home factory. Through the expiration of the original patent rights and the duplicating of their machines by foreign manufacturers it was no longer possible to pay foreign custom duties and be able to compete with the foreign makers, but it is hoped that by manufacturing with superior American machinery and methods they will be able to successfully compete with the foreign manufacturer upon his own grounds, thereby continuing to hold the foreign trade they have so long enjoyed.

The city storage warehouse, erected in 1906, is located very conveniently to the city and is built entirely of iron-concrete. It is 656 feet long by 45 feet wide and four stories high. It cost about 400,000 marks ($95,000). The rental is made upon a 6 per cent basis of the cost of building. This building is rented to spediteurs and forwarders who are especially interested in building up the trade and traffic of the harbor. Special facilities have been furnished for the convenient handling of freight. Twenty railroad tracks, three half-portal cranes, elevators, and one large bridge crane are at hand to quickly remove the cargoes from ship or car to the storehouse, or vice versa.

In 1908 a large basin was built to accommodate the large rafts of logs arriving from the Schwarzwald (Black Forest). This basin has a wharfage length of 12,795 feet and a water surface of 158,000 square meters.

Since 1903 the following improvements have been finished or started:

The new harbor basin; begun in 1905, finished 1908.

Widening the old harbor and connecting it with the new harbor; begun 1907, finished 1908.

Building the Ring and Harbor Railroad, with a total length of rails of 21 miles; begun in 1904, finished in 1908.

The beginning of a new parallel basin; begun June 25, 1909. In November 247,000 cubic meters had already been moved.

A large flour mill at Neuss cost about 2,500,000 marks ($595,000), and has a capacity of 2,500 sacks of wheat or rye per day. This is the

largest industry situated on the old harbor. Two ship elevators having a capacity of moving 220,000 pounds of grain per hour have been installed. Neuss has an important trade in flour and grain. Neuss is also an important market for lumber; large sawmills and lumberyards covering 50,000 square meters of space are situated on the harbor. Large imports of American sawed lumber are regularly received by this cheap water transportation.

Since 1905 thirty large industrial firms have bought space and built their factories or plants on the new Neuss Harbor, which offers an excellent example of the rapid increase of business and also of population.

Every facility for the quick and convenient handling of freight has been provided by the city. They have two steam towing boats of 180 tons each, which are provided with pumps for fire purposes. The city railroad possesses 100 wagons and 5 locomotives. Prices for towing and unloading vessels are made as low as possible, as may be seen in the accompanying lists of charges. This undertaking which has been so successfully planned and carried out offers an excellent illustration of the possibility of a city in reduced circumstances, and with only a population of 4,000, assuming obligations of 8,000,000 marks and developing the undertaking to a point where its ultimate success is assured. At present there is a deficit of about 30,000 marks ($7,140) per year which is made up by the city. A plot of 25 acres of ground on the new canal was recently sold for 400,000 marks ($95,000), or $3,800 per acre. Without the new harbor improvements this land would not have been worth one-tenth of this amount. The city has also increased in population to 35,000 and is growing at present at the rate of 1,000 per year. What the city gains in taxable property and trade with this great increase more than makes up for the debts incurred. If the city had not looked into the future and made provision for it by the public utilities it has installed, it would still be a small village of no importance, as it was years ago after the Thirty Years' war.

There are employed in the harbor, on the railroad, the towboats, and for policing the harbor, and for running the cranes, and as laborers, from 160 to 200 men. They are paid from 3.50 to 4 marks ($0.83 to $0.95) per day, inclusive of all Sundays and holidays.

For more minute details as to statistics of the growth of the traffic, amount of freight handled from year to year, etc., see two books entitled "Rhein-Erft-Hafen" and "Festschrift" of Neuss, 1908.

The amount of customs collected in the harbor of Neuss increased from 4,907,340 marks ($1,127,994), in 1906, to 7,514,144 marks ($1,788,366), in 1908.

### The Düsseldorf Harbor.

The development of Düsseldorf as a river port of importance dates from the year 1288, when Graf Adolf V. Von Berg granted special privileges to the city, allowing it to collect revenue from all passing vessels on their way to the mountains. Many of the ruling barons having portions of their domains on the Rhine, including the great Bishopric of Cologne, fatted on the tribute collected from the river traffic, and this condition lasted for many years.

The growth of the city and of its trade was necessarily slow and seriously retarded owing to the so-called "Staple right," which had long been enjoyed by its powerful neighboring city Cologne. This right compelled all passing vessels to unload and put their cargoes on sale for at least three days, after which time they were at liberty to reload the unsold portion of their goods and transport them farther up or down the river, as they wished.

High duties were collected (Rheinzölle) not only here, but in many other places on the Rhine, and under such burdens it was impossible that a healthy growth in the business of navigation should exist.

Napoleon abolished the Rhine duties, but new tolls were levied, such as octroi, recognitions, and bridge-passing taxes, and the old unloading right at Cologne continued for many years.

Nothing had been done in the way of improving navigation upon the river, and it was not until about 1831 that bordering States passed an act binding themselves to improve the channels and to secure the banks where necessary from washing away and to prevent inundation. At this time the levying of tolls and taxes at the different landing places had become so burdensome that the Cologne-Düsseldorf Steamship Company were obliged to pay an annual sum of 20,000 thalers ($14,280), equal to 2 per cent of their entire invested capital. Fortunately, in the year 1868 an act was passed abolishing all of these burdens of tribute, including the unloading law at Cologne, making the river free.

### WHARVES AND HARBORS.

At all important places of trade upon the river new improvements were now made to meet the ever-increasing flow of traffic. Düsseldorf, however, lost many valuable years in a warmly contested discussion as to what the new improvements should consist of and as to where they were to be built. Finally plans were perfected for a new harbor to be built on the south side of the city on a peninsula caused by an acute bend in the river convenient to the city and its river frontage, and work was commenced early in 1891 and the harbor was finished and opened for use with appropriate ceremonies on May 30, 1896.

In order to utilize the river front, which extends along the entire old part of the city from the harbor entrance to the new Rhine Bridge and to afford adequate protection from inundation in times of high water, work was immediately started to build a solid stone quay and dock along this important way. Plans were made to raise and fill in the river front at the same time, so that the quay would be high enough to afford security against any possible river floods. These plans were also made to conform with those for the new Rhine Bridge, that was built in 1896–1898. The approaches to the bridge were filled in, forming a level the same height as the quay to which they were finally connected, and this wall, together with the "Napoleon safety harbor," forms a complete dike for the city. This dock is built mostly of cut stone and basaltic blocks, and is provided with ample facilities for docking and landing passengers and freight. The city has also boulevarded and beautified the broad

street back of the wharf, thereby adding much to the beauty of the city. This great work was not finished until 1902, since which time it has been in constant use. Being in direct communication with the harbor, it makes a most modern industrial landing. This, together with the most excellent facilities for moving freight, proves a constant attraction for various industries to take advantage of excellent conveniences offered. The available ground for building and other purposes contained in the harbor covers about 335 acres, of which about 40 acres are immediately adjacent to the harbor basins. It also has over 6 miles of wharf, which makes it one of the largest artificial harbors extant.

The uses of the harbor are varied, giving excellent opportunities for the forwarding of through freight from river and sea inland by rail to the most thickly populated and greatest manufacturing center of Germany, or vice versa, from land to water. There are 150 acres of wharf space, conveniently connected by the harbor railroad, with the best modern equipment for storage.

Over 6 miles of broad well-paved roads connect the harbor basins and wharves with the city and the surrounding country. Forty electric cranes, with lifting power from 3,500 to 56,000 pounds, are erected at convenient places on the wharves for public use at a reasonable price. There are also special traveling cranes for loading and unloading sand and coal. Ships are not compelled to pay harbor charges, excepting those which enter the harbor to escape the danger of ice, without loading or unloading, when a fee is charged on the tonnage. A fixed rate of charges, according to value, is levied on all incoming freight by water, while outgoing freight is free.

The city has provided special protection for the harbor against fire and thievery. A special fire company, with an auto chemical engine, fire hose, and hook and ladder, are on watch both night and day for immediate attack, and are also connected with the city fire department. Notwithstanding the fact that the entire harbor is piped with the city water mains, a special high-pressure system has been installed for pumping water from the harbor basins, so that it is possible to reach the highest buildings with water to quench the fire. Fire steamers are also constantly on duty.

A police station, with sufficient force to patrol the entire harbor both day and night has been established. The harbor is well lighted by several hundred street lamps and electric arc lamps. Electricity is also furnished for cranes, elevators, motors, etc., part of the current coming from the temporary harbor plant and part from the city electric works. The current is furnished to the harbor tenants at regular city rates.

The customs harbor has been provided, entirely at the expense of the city, with necessary buildings. A fine customs building, six stories high, built of stone and iron and concrete, is used for the combined purpose of customs collecting and for a bonded warehouse. It is lighted with electricity throughout and has elevators from cellar to roof, and cranes for loading and unloading. It is divided into three compartments with fire doors, and is both fire and rat proof. A public warehouse has also been provided; it is 540 feet long, is also built entirely of iron and concrete and is fireproof. Space in this building is rented to those desiring it at a reasonable rate.

Düsseldorf has now become an important trade center and its harbor and wharves are among the largest on the Rhine. Space bordering the harbor basins and docks was rapidly leased for all kinds of industries, until all was taken. Because of constant applications for more harbor space and the fact that the traffic had increased threefold since the beginning, it was decided to extend some of the old basins and build new ones, which would add new leasing space of at least 50 acres. This new work was partly finished in 1887 and partly this year, 1909.

The old petroleum harbor was abolished and placed at a more safe distance from the city; a new plant was built, with excellent facilities for storing and pumping the oil, also a factory for the distillation of benzine. The old petroleum harbor was utilized as a new harbor basin.

Already much of this new space has been leased to various industries desirous of taking advantage of the cheap rates for receiving their raw materials by water transportation. The length and cost of the leases are made according to the value of the building, or plant, that is erected. They are subject to revaluation from time to time, according to the increase in value.

The entire harbor is constructed without bridges or locks, and is in direct connection with the Rhine by an entrance 250 feet wide. All of the basins have a depth of 6½ feet below the mean low-water mark of the Rhine, so that vessels can ride in safety with no danger of grounding at low water. This depth not only accommodates the largest river steamers having direct connection up the river as far as Strassburg but the large ocean-going steamers making direct transit with London, Rotterdam, Antwerp, and the Baltic ports as far as St. Petersburg.

Cheap freight rates to all parts of the world are offered by local forwarders over all domestic and foreign lines, and this port is already recognized as an important harbor for seagoing vessels.

A harbor freight station has been provided in connection with the harbor railroad system, which forms a gate to the harbor railroad. Fees for unloading, handling, and transport of freight end here, as far as harbor charges are concerned, and the state railroad tariff begins.

A harbor has been constructed at Heerdt, on the left bank of the Rhine, that takes care of the traffic on that side. It has ample railroad connections and will be increased in size as fast as the increase of traffic demands. This increase is growing rapidly, as is shown by the following: 24,211 tons of freight were handled in 1900, the first year, and for the year 1908, 257,587 tons were turned over.

All of the work in harbor building and improvement has been done entirely by the city of Düsseldorf at an original cost of 18,000,000 marks ($4,284,000). Owing to the great expenditure on the new harbor extension the income is sufficient to pay a fair interest and sinking fund on the investment, but the rapid growth of traffic, which has increased from 376,877 tons in 1895 to 1,083,333 in 1908, is most reassuring.

Düsseldorf is the ninth city in Germany, and has a population of 350,000. It is known as the "Garden City," and is situated in the

center of the greatest manufacturing district in Prussia. Within a radius of 20 miles there is a population of 5,000,000 people.

Three hundred and twenty trains arrive and depart from the central station carrying passengers only, a service excelled by few German cities. In 1907 there were 14,850 factories, employing 98,902 workmen. The increase in general business is well illustrated by the receipts and expenditures of money at the branch of the Imperial Bank located in the city. In 1899, 1,993,313,100 marks ($464,458,514) were handled, and this increased to 4,327,488,300 marks ($1,029,792,215) in 1907. The collection of customs and indirect taxes in the Düsseldorf harbor increased from 12,638,620 marks ($3,007,991) to 23,967,328 marks ($9,107,444) in 1908.

## RIVERS AND CANALS IN THE CONSULAR DISTRICT OF COLOGNE.

Report by H. L. Dunlap, *Consul.*

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This report refers only to the rivers Rhine and Moselle, which are the only navigable streams within the borders of this district. There is no canal within the district, so that no reference is made or intended in regard to that portion of the subject.

### I. Public Supervision.

(*a*) The duty of supervising improvements, initiating new ones, and caring generally for the river is in the hands of the Rheinstrombau Verwaltung (commission for the improvement of the Rhine), with headquarters at Coblenz. This commission has general supervision from the border of Holland to that of Switzerland, and once each year, accompanied by representatives of the transportation companies, members of the several boards of trade of the cities on its banks, and members of the agricultural societies of districts through which the rivers flow, journey from one end of the district to the other, holding consultations with the authorities where improvements or changes are asked for and making a thorough inspection of all proposed improvements. Afterwards the commission meets, considers all propositions before it, makes its recommendations, asks for appropriations, and sends its report to the national government at Berlin, which approves or disapproves as it sees fit.

(*b*) (1) This commission possesses no power whatever over navigation corporations. (2) It has no power to regulate freight rates. (3) It publishes an annual report of its doings. (4) It maintains the channels of the streams so far as the money appropriated by the general government permits. It has no control over docks and terminal facilities, which are the property of the municipalities.

(2) The statistics of water-borne traffic are collected by the authorities of all cities and villages and are published in book form by the Zentralkommission für die Rheinschifffahrt (central commission of Rhine traffic) in Mannheim, which includes them in its annual report along with other statistical information.

### II. Waterway Improvement.

(*a*) No water power is developed by the improvement of rivers for navigation purposes.

(*b*) The general government has undertaken the improvement of navigable rivers entirely; there is nothing done by local governments or private enterprise.

The Prussian Government has, according to a statement made by the president of the Rhine Province at Coblenz in answer to inquiries, spent about 50,000,000 marks ($11,904,738) in the improvement of the river. This improvement consists in building walls to prevent erosion of the banks, contracting the width of the river to increase its depth by projecting walls of stone running into the river to hinder the flow and confine the water to the channel, and by blasting rock to deepen the channel in shallow places and dredge it where there is a clay or sand bottom. This dredging is kept up continually, and considerable revenue is derived from the sand taken out at points where it collects and fills the channel.

## III. Floating Equipment.

(*a*) There are in use on the Rhine and its tributaries 11,077 boats of all kinds, according to the latest report obtainable, of which 1,318 are steam passenger, freight, or tow boats, and 9,759 freight barges of varying sizes. The steamboats possess 295,848 indicated horsepower, and the barges have a capacity of 3,960,378 tons.

There are a few ocean steamers of 1,500 tons which go up the river as far as Cologne, up to which city the average depth of water is 9 feet; at low water considerably less. A line of freight boats makes daily trips to Rotterdam, in Holland, having a draft of 1.20 meters (46 inches). The passenger steamers running from Cologne to Mainz draw even less, but they are used only for passenger traffic, mostly during the tourist season.

All the freight traffic above Cologne is carried in barges, towed by either side-wheel or propellers built especially for that purpose. Of these Rhine steamers, 172 are side-wheel, with 112,338 horsepower, and 1,146 propellers, with 183,511 horsepower. Of this number 99 are passenger, 68 passenger and freight, 192 freight, 18 freight and tow, 896 tow, and 45 in different uses. Of the 9,759 barges, 6,637 are iron or steel with 3,443,297 tonnage, and 3,122 wooden boats, with 517,081 tonnage. The Rhine fleet, owned in Germany, is valued at 250,000,000 marks ($59,523,809) and is composed of 682 steamers with 188,690 horsepower and 2,800 barges, with 1,881,261 tonnage.

### Size and draft.

The largest passenger steamers running above Cologne are 83 meters long, 8.2 meters broad, and 1.30 meters draft, with 1,250 indicated horsepower (length, 272 feet; width, 27 feet; draft, 51 inches). The largest freight steamers from Rotterdam are 83 meters long (1 meter=39.37 inches), 10.08 meters broad, and 2.77 meters draft, with a load of 1,306 tons, the engines indicate 600 to 650 horsepower.

Of the tow steamers which comprise more than two-thirds of the fleet the largest have from 1,500 horsepower down. The largest screw towboats are 43 meters long (meter=39.37 inches), 10.06 meters wide, and 4.38 meters draft, with a load of 1,770 tons, indicated horsepower, 600.

The largest barges are 123 meters long (meter=39.37 inches), 14.08 meters wide, 2.85 meters draft, and a tonnage of 3,581 tons.

COST OF BOATS.

The price of modern side-wheel towboats complete is from 250 to 350 marks (mark=23.8 cents) for each indicated horsepower; of screw towboats, 200 to 260 marks (mark=23.8 cents) for each indicated horsepower; barges from 50 to 55 marks for each ton.

(6) There are no special types of boats used for different purposes or on different reaches of the river, that being governed entirely by the depth of water.

(7) Each towboat, according to size, tows from four to six barges, that depending upon the size of barge and the tonnage. Longer tows are not possible, owing to the crooked channel in places, for if too long the last barges would be liable to ground.

(8) All barges are used wherever the depth of water permits.

## IV. Ownership of Vessels and Business Organizations.

(*a*) No vessels are owned or operated by canal companies.

(*b*) There have been no instances of combination in the Cologne district. Attempts to combine have been made, but not successfully.

(*c*) Vessels are not owned at all by railway companies. Many of the boats, both tow and barges, are owned by the coal-mining companies, whose output they transport.

(*d*) The public authorities own and operate no vessels.

(*e*) So far no combination of towing has been successful in securing the cooperation of sufficient firms owning towboats to make a monopoly or trust. Sufficient independent lines have remained out to render all such attempts unsuccessful.

## V. Terminal Facilities.

(*a*) All the docks and wharves along the river, except those of refuge from ice, are owned by the municipalities. Wharf boats are usually owned by the transportation companies and are inexpensive affairs. At the cities of Mülheim, Cologne, Coblenz, and St. Goar, in the Cologne district, there are artificial harbors dredged to a sufficient depth, walled on both sides, amply provided with customs warehouses and administration offices, steam cranes and elevators, scales, railway tracks, etc. Ground is rented to private parties for the erection of private warehouses, where goods not dutiable are loaded and stored.

The two harbors at Cologne cost, respectively, 23,000,000 marks ($5,476,904) and 7,000,000 marks ($1,666,666).

(*b*) All loading and unloading of merchandise and other goods capable of being so handled is done by steam cranes, owned by the municipality.

(*c*) All harbors and loading places are connected with the State railways, which are so arranged that goods may be loaded from boats into cars, or vice versa. As the railways are all State owned, they necessarily all connect either with belt lines or connecting tracks.

(*d*) All river terminals and wharves are owned by municipalities, except in rare cases where landing stages have been built by the steamer companies.

## VI. Tolls and Freight Rates.

(*a*) Tolls are not charged on rivers as yet, but the proposition to charge them has been seriously considered and will in time, no doubt, be inaugurated.

(*b*) The elements of depth of water and scarcity of loads enter into the rates of freight, which vary weekly, oftentimes daily. There are no towing companies in this consular district.

(*c*) Tariffs are irregular, but classification is regular. Competition, however, and amount of freight offered have much to do with rates.

(*d*) I am not able to reply to any of the questions under this heading.

(*e*) There are no joint rail and water tariffs in this district. The rail tariffs on the river depend on circumstances, and should there be an agreed rate by river and rail the river transporter must be the one to gain or lose.

(*f*) There is no competition whatever between the railways and waterways.

(*g*) The railways being state-owned, have a tariff that can not be varied. There is no competition between lines, no soliciting or rebate agents. There is no agreement of any kind with the river transport companies.

(*h*) It would be an unheard-of thing to ask for a reduction of railway rates for any reason. They are as fixed as the laws of the Medes and Persians.

As a general thing goods for foreign shipment are insured by the owner or forwarder. Internal traffic is not generally insured. Freight rates are not affected by insurance.

## VII. Water-Borne Traffic.

(*a*) Traffic on the Rhine from Cologne to Rotterdam consists of all kinds of merchandise, such as package freight consisting of manufactured goods, tallow and oil in barrels, fertilizer in sacks, cotton in bales, hemp and sisal in bales, copper and lead in ingots, machinery, which articles are generally transported by freight steamer. By barges from seaports, the cargo generally consists of grain, oil, cotton, etc. The local transportation up the river is largely coal, which is mined in the Barmen consular district. Down-river traffic consists largely of paving stones, cement, mine supports, telegraph poles, lumber, wood, etc. The principal freight on the Rhine between Ruhrort and the upper reaches is, of course, coal.

(*b*) I am unable to obtain statistics of water-borne traffic. The Centralkommission für die Rheinschifffahrt at Mannheim, Baden, publishes a yearly report which contains about all the statistics for shipments on the Rhine.

(*c*) Taking the Rhine and Moselle Rivers for examples, local traffic, i. e., that originating along these streams is much greater than traffic originating elsewhere owing to the coal mined and lumber cut in their vicinity.

(*d*) As all the river transportation companies have their headquarters in other districts, no doubt other consuls will cover the pay for workmen, such as boatmen, firemen, engineers, etc. The pay of men employed in the Cologne Harbor varies from 3.50 marks per day for common laborers to 8 marks (mark=$0.238) for engineers and foremen.

The amount of wages paid to employees of steamships, customhouse employees, and dock laborers, as given by the superintendent of the harbor, is shown by the following table:

| Employment. | Weekly wage. | Monthly wage. |
|---|---|---|
| | *Marks.* | *Marks.* |
| Engineers on boats, first class | 35.00 | ..... |
| Engineers on boats, second class | 30.00 | ..... |
| Engineers on towboats, first class | 45.00 | ..... |
| Engineers on towboats, second class | 34.00–35.00 | ..... |
| Engineers on dock cranes | ..... | 300 |
| Firemen on steamships | 25.00 | ..... |
| Firemen on towboats | 28.00–30.00 | ..... |
| Firemen on cranes | 31.50 | ..... |
| Clerks in customs department | ..... | 200–340 |
| Inspectors of customs | ..... | 285–465 |
| Watchmen at customhouse | ..... | 180–220 |
| Deck hands on steam and tow boats | 21.00–28.00 | ..... |

## CLOSING REMARKS.

The regulation of the water in the Rhine is considered as finished by the commission. Additional improvements are being considered, one being to make the upper river navigable from Strassburg to Basle, in Switzerland, 127 kilometers (about 80 miles), which is not at present navigable except at high stages of water and as a result of deepening the channel at several points.

Traffic on the Rhine is continually on the increase. No statistics are at hand to show the total tonnage, but that passing between Germany and Holland at Emmerich, which can not be more than half, was for the years 1890, 5,883,000 tons; 1900, 13,192,000 tons; 1908, 21,834,000 tons.

Freight rates fluctuate according to the amount offered and the stage of water. In 1907 rates between Rotterdam and Mannheim (570 kilometers) were from 2.25 marks to 10 marks per ton (mark= 23.8 cents); between Ruhrort and Mannheim (350 kilometers) in April, 1907, 1.61 marks, and in November 5.81 marks per ton.

The average navigable width of the river varies below Cologne 150 meters (39.38 inches), with an average depth of about 10 feet; above Cologne from 2 to 2½ meters.

Formerly a part of the river was supplied with a large chain, which, passing over a drum on the tug, provided means for hauling loads over rapids, and I believe this system is still employed between Mainz and Frankfort.

There are no great fluctuations in the depth of water in the Rhine, although it flows through a semimountainous country. The snowfall is not excessive and the hills are all covered with evergreen, whose shade retards the rapid melting of snow and also retards the

rapid running off of the rainfall. After the most severe rains or sudden thaws the rise is not much over 15 feet, seldom so much, and reasoning from this one might infer that were the hills in Pennsylvania near the source and along the flow of the Alleghany and Monongahela Rivers covered with spruce or pine the rapid rise and destructive currents of these rivers and of the Ohio might in a considerable measure be prevented.

As before mentioned, the Rhine is provided with artificial harbors owned by the municipalities; in addition the State has provided harbors of refuge where boats may seek cover from floating ice. No injury to shipping is done by the breaking up of ice in the spring, as is the case in American rivers, notably on the Ohio.

# INLAND WATERWAYS AND CANALS IN THE CONSULAR DISTRICT OF BRESLAU.

Report by HERMAN L. SPAHR, *Consul.*

The principal waterway in this district is the Oder River, with its tributaries and canals. The Oder rises in the Austrian Province of Mähren, enters Germany near Oderberg, flows through the Prussian Provinces of Silesia, Brandenburg, and Pomerania, and empties into the Baltic Sea. It is 900 kilometers (559.23 miles) long, and its source is about 634 meters (2,080.04 feet) above sea level. The stream is divided as follows, according to the varying character of the valley:

| Name. | Length. | Fall. |
|---|---|---|
| The source Oder to the Olsa River, near the Austrian border. | 133 kilometers (82.64 miles) | 1:300 |
| The upper Oder to the Weide River, below Breslau | 225 kilometers (139.81 miles) | 1:2,750 |
| The middle Oder to the Warthe River, below Kuestrin. | 351 kilometers (218.1 miles) | 1:3,620 |
| The lower Oder to Stettin | 147.4 kilometers (91.6 miles) | 1:13,440 |

The longest tributaries are the Warthe, the Bober, the Lausitzer Neisse, the Glatzer Neisse, and the Bartsch.

The Oder proper is navigable from Ratibor, in Silesia, to the sea, 752.5 kilometers (467.58 miles). The total length of navigable waterways in the Oder system is 2,184 kilometers (1,357.07 miles), of which the most important tributary, the Warthe, furnishes 347 kilometers (215.62 miles), and its arm, the Netze, with canalization, over 300 kilometers (186.41 miles).

Important canals are the Klodnitz, the Bromberg, the Finow, the Friedrich Wilhelm, and the Oder-Spree, while the channel for large ships (Grosschiffahrtsweg) at Breslau is also of prime importance.

The Klodnitz Canal was dug in 1790 from Gleiwitz to the Oder below Kosel. Length, 45.66 kilometers (28.37 miles); fall, 49.18 meters (161.35 feet), overcome by 18 locks. It enables the great coal and iron industry of Upper Silesia to use the waterways. The lock dimensions are, however, too small to meet modern demands, offering an uninterrupted progress only to smaller boats. Since the opening of the Upper Silesian Railway—1856—the products of that district start mostly by rail.

The Bromberg Canal was begun in 1772; it cost originally 2,052,400 marks ($488,471), but has been much improved since that time. It connects the Netze River—hence also the Warthe and the Oder—with the Weichsel, and has 10 locks.

The Finow Canal was dug in the seventeenth century and joins the Oder (at Hohensaaten) with the Havel and thus with the Elbe.

The ancient Friedrich Wilhelm Canal joins the Oder at Brieskow with the Spree and thus with the Elbe.

*The Oder-Spree Canal.*—Since the two last-mentioned canals were not built for large boats, it was determined to construct another canal to permit ships of 400 and 500 tons burden, measuring 55 by 8 meters (180.45 by 26.24 feet), to ply both the Elbe and the Oder. The canal begins at the Seddin See and enters the Oder near Fuerstenberg, 23 kilometers (14.29 miles) above the Friedrich Wilhelm Canal, using in its course part of the latter and also part of the Spree River. The busy industrial section of upper Silesia is thus enabled to forward its products direct by water to Berlin and Hamburg in large ships from Kosel. The Oder-Spree Canal was finished in 1890; it is 87.9 kilometers (54.62 miles) long, of which 55.6 kilometers (34.55 miles) had to be dug.

The Grosschiffahrtsweg at Breslau was completed in 1897. Up to that time the city was the upper terminus of the heavy shipping, as no boat over 175 tons could pass the locks there. The canal passes around Breslau to the north, using in part an arm of the Oder. It has 18 meters (59.05 feet) bottom width and a minimum water depth of 1.50 meters (4.92 feet). The five locks are each 55 meters (180.45 feet) long, and 9.5 meters (31.16 feet) wide, sufficient for 400-ton ships. With the construction of this canal—preceded by the enlarging of the locks at Ohlau and Brieg, the canalization of the Oder from Kosel to the Neisse mouth, and the building of a transfer haven at Kosel (all completed in 1895)—the rapidly developing navigation on the lower Oder was brought into close touch with the great mines and works of Upper Silesia.

## I. PUBLIC SUPERVISION.

(*a*) The rivers and canals of Prussia are under the jurisdiction of the Prussian Government, and the departments of public works, commerce and trade, and agriculture have supervision over measures of improvement, regulation, navigation, and protection. The authority is delegated by law to various royal waterways-improvement commissions, among which in this section may be mentioned the Oderstrombauverwaltung, for the Oder from the Austrian border to Schwedt, near the Pomeranian boundary, and the Strombauverwaltung der Märkischen Wasserstrassen, for Pomerania and the waterways between the Oder and Berlin (except the Stettin and Berlin district).

The Oderstrombauverwaltung was established in 1874 for the stretch from Breslau to Schwedt, but in 1879 its authority was extended to the Austrian line. It has its seat at Breslau, and consists of the governor (Oberpraesident) of Silesia as chief, and his substitute; the director of Oder improvements (Oderstrombaudirektor and his substitute; a judiciary; a secretary; also 9 inspectors, 9 district inspectors, 5 supervisors, and 12 assistants, all with titles of Regierungs-und Baurat, Baurat, Bauinspektor, Regierungsbaumeister, or Wasserbauinspektor.

The stretch delegated to this commission is divided into nine water inspection districts, each under a district inspector with a stream master, stream overseer, lock master, haven master, dredging master, etc. Municipalities or corporations constructing havens, loading places, etc., at their own expense have control of these with government supervision.

In 1881 the Oder navigation commission (Oderstrom-Schiffahrts-Kommission) was established on the same plan as the navigation commissions for the Rhine and the Elbe. It makes a biennial inspection trip over the navigable course delegated to the royal Oder improvement commission (from Ratibor to Schwedt), and suggests, approves, or opposes projects. The standing members are the Oberpraesident of Silesia as chairman, the Oderstrombaudirektor, inspectors of navigation, and other technical and non-technical officials charged with navigation, commerce and dike matters. Occasional members are unlimited, being suggested each year by the interested chambers of commerce, shipping and mining companies, agricultural and dike associations, and are selected by the chairman with regard to the matters to be considered.

(*b* 1) With capitalization of navigation corporations the Oderstrombauverwaltung has no concern. The Government frequently authorizes by statute a loan to dike associations.

Freight rates are fixed by the ship owners, companies, and associations. The commission has no power to regulate them. Reports of operation are made by the district inspection bureaus.

The maintenance and the improvement of the channels and the building and maintenance of all government constructions constitute the main duties of the commission over the stretch prescribed. For instance, in 1906 the following were the principal matters handled:

Works begun: Extension of improvement works between Ratibor and Kosel; improvement of the Oder at Oswitz below Breslau; building of two locks in the canalized Oder for towed fleets. Works continued: Putting up two electric coal dumpers in the Kosel haven; building a third dock for the Kosel haven; building a lock sufficient for towed fleets near the mouth of the Neisse.

Works completed: A winter haven at Frankfurt: channel improvement from Ratibor to Kosel.

(*b* 2) Statistics of water-borne traffic are collected at the various locks, havens, etc., by the responsible authorities and published officially by the improvement commission every two years in its Mitteilungen (pamphlet of information). The latest issue appeared in 1907; the 1909 issue has not yet been distributed. The local statistics are furnished annually for the reports of the various chambers of commerce. Complete statistics for the inland waterway traffic, with much other material, are compiled by the Imperial Statistical Office with the assistance of the commissions, and published whenever the upper house of the empire requires it. The volume concerning the Oder and other Baltic rivers was issued in 1876, 1891, and 1908.

## II. Waterway Improvements.

(*a*) See the comprehensive report on Prussia's policy in regard to water power, by Consul General Thackara, in Monthly Consular and Trade Reports, January, 1909, pages 132 to 135.

(*b*) River improvements and construction of canals in this territory have in general been carried on at the cost of the Prussian Government whenever the main object is to better navigation and promote commerce and trade. Municipal and private enterprises are permitted when conforming to the uniform plan adopted for the course. Where protection against floods is involved the provinces, communities, industries, and farmers affected are assessed according to the advantage received.

Noteworthy examples of Government works are the Kosel transfer haven, the canalization of the Oder from Kosel to the Neisse with 12 locks, securing a continual water depth of 1.5 meters (4.92 feet), and the canal for large ships at Breslau (described above). The money for these three works (over $5,000,000) was obtained by the law of June 6, 1888, authorizing a loan.

The city haven at Breslau, built (1897–1901) at a cost of 5,500,000 marks ($1,309,000), is the most important illustration of municipal enterprise. It is located at the lower end of the channel for large ships. The expenses in the fiscal year 1906–7 exceeded the receipts by 183,240 marks ($43,251), requiring an appropriation from the city treasury. The city haven at Neusalz, and the Teltow Canal, near Berlin (built by the county of Teltow), are other examples.

Examples of private enterprises on the Oder are the haven of the Frankfurter Gütereisenbahn-Gesellschaft at Breslau and Frankfurt, and of Caesar Wollheim, near Breslau.

In the case of protection against floods, private industries and farms receive a benefit, in proportion to which they are assessed to help pay the cost of the dikes. The Government may take the land necessary for such works under the right of eminent domain. Dike associations are chartered in the districts affected, and a Government commission, with an expert, works out the plan and the rate of assessment. State appropriations and loans lighten the burden. Since 1848, 57 dike associations have been chartered as "Meliorationsgenossenschaften." For example, the Deichverband Aufhalt-Glauchow diked 40 kilometers (24.85 miles) in 1866 at a cost, including drainage, of 1,048,515 marks ($249,546), of which the State gave 200,000 marks ($47,600). By 1906 the association's obligations were all paid off except 254,000 marks ($60,452). The Deichverband Barteln-Scheitnig repaired and improved its dike after the flood of 1903 at a cost of about $4,000, the State giving $1,904, and lending $1,842, the province giving $204.

After the great flood of July, 1903, it was determined to improve and extend the entire dike system under the supervision of the Oder Navigation Commission, and the general plan of contribution agreed on was as follows:

1. The total cost not to exceed 60,000,000 marks ($14,280,000).

2. The cost of measures of benefit to dike associations and public corporations to be borne by these to the extent of the benefit; where they are unable to contribute, or the cost exceeds the benefit, the province and the State are to aid.

3. The cost of measures of general interest to be borne by the province and the State, with the right to assess associations, etc., when these are benefited by the measure.

4. The province to pay one-fifth and the State four-fifths of the costs falling to their lot.

5. For changing Government works the State to pay all costs; for regulation measures between Kuestrin and Raduhn the State to pay down 7,000,000 marks ($1,666,000) for dredging.

## III. Floating Equipment.

(*a*) To the Oder system properly belonged 3,874 vessels in 1905, of which 3,039 were river boats (Segelschiffe), 563 canal boats, and 272 steamboats. Of the sailboats, 62 were also canal boats. The steamboats were classified thus: 92 passenger vessels (including 10 motor boats), 37 freight vessels (12 being also tugs), 137 tugboats, 1 motor boat, and 5 ferryboats. Of the passenger steamboats, 4 were freight and tug, 18 freight, 27 tug, and 2 ferryboats. Other boats, however, come in from other river systems, principally from the Elbe.

(1), (2) The upstream movement is almost exclusively by means of steam tugs. Sailing boats are found in small numbers below Frankfort and above Oppeln. Small sails are, however, frequently raised on towed boats to increase speed when the wind is favorable. The freight boats usually float downstream, although tugs are sometimes employed. On the uncertain stretch between Kosel and Ratibor, where only smaller boats can ply, poles and pulling are brought into play.

(3) The following table shows the size and draft of the most frequent kinds of boats plying the Oder:

| Popular name. | Capacity. | Average measurement. | |
|---|---|---|---|
| | | Length. | Width. |
| | *Tons.* | | |
| Finow boats | 150 to 220 | 40 meters (131.09 feet) | 4.6 meters (15.09 feet). |
| 16-footers | 250 to 300 | 43 meters (141.07 feet) | 5.3 meters (17.38 feet). |
| Berliner | 300 to 350 | 47 meters (154.2 feet) | 6.5 meters (21.32 feet). |
| Large boats | 450 to 550 | 50 meters (164.04 feet) | 8.0 meters (26.24 feet). |

The draft is up to 1.65 meters (5.41 feet).

Smaller boats, carrying less than 150 tons, enter the Oder through the Klodnitz Canal.

(4) The sailboats (in 1905) were all of wood, with the exception of 37 of iron. Of the steamboats, only 11 (3 passenger, 3 freight, 3 tug, and 2 ferries) were of wood; in the rest the principal material was iron.

(5), (6) The type oftenest seen is the Oder boat. It occurs in various sizes, nearly always of wood (generally pine or oak), though in recent years iron or partly iron boats have also been built for the lower Oder, mainly for use as towboats. The Oder boats are nearly all flat-bottomed with movable deck. The rigging consists of mast, pole, large sail, middle sail, storm sail, a fourth sail, and the necessary ropework. On the lower river some have sharp keels and stationary decks. From Breslau up, where the size is limited by the lock dimensions, the boats are flat-bottomed with pointed bows. Below Breslau the middle-size boats, 40 to 44 meters (131.23 to 144.36 feet) long, in part have pointed bows, in part round, bulging bows.

The latter, called Butzer, are mainly used as towboats. They move forward more easily and have a better capacity.

The Zillen, better known on the Elbe, are lightly built with small draft, e. g., a Zille 37.6 by 4.5 meters (123.35 by 14.76 feet) carries 75 tons and draws 1.1 meter (3.60 feet). Those on the Oder are usually built of deal or pitch pine, without a deck.

The Oder boats and Zillen are usually called Finow boats when they are of a size to pass the Finow Canal.

On the Warthe, with favorable water, large Oder and Elbe vessels (400 to 500 tons) come up to Posen, and ordinarily the Finow boats with as much as 200 to 250 tons.

(7) The highest number of loaded barges permitted to be towed upstream in one fleet is:

On the canalized Oder to the Neisse mouth, not to exceed 8 ship lengths.

On the Oder, below the Neisse to Nipperwiese—not to exceed 8 ship lengths.

On the Warthe and lower Netze, below the Drage mouth—8 vessels.

On the lower Netze, below the Drage mouth—5 vessels.

On the upper Netze, Bromberg Canal, and Brahe—2 vessels. Downstream the limit is in each case 2 vessels.

(8) The maximum dimensions allowed on account of the Oder locks are: Length, 55 meters (180.44 feet); width, 8.2 meters (26.9 feet); but a maximum draft has not been fixed, lest traffic be hindered in times of exceptionally favorable water conditions. The Oder has not a uniform flow like other German streams, but varies with the distribution of the precipitation, being more strongly influenced by the tributaries on the left than by those at the source. This and the strong fall in the upper length makes the stream most difficult to regulate and requires an unusual number of locks. As smaller boats have a relatively large draft, the usefulness of the boats depends mainly on the depth of the water, which is regularly ascertained at the numerous gauges and the vessel movement in uncertain periods is adjusted thereto.

## IV. Ownership of Vessels and Business Organization.

(*a*) There are no canal companies or other waterway improvement companies, as such improvements are made by the State.

(*b*) There are a few cases of consolidation of vessel owners into corporations, such as the Viktoria Transportgeschäftselbständiger Schiffer and the Neuer Verfrachtungsverbandselbständiger Schiffer, both limited companies.

The government railroads do not own or operate vessels and producing and distributing concerns do so only in a few instances, as, for example, on the upper Netze, where the larger sugar, soda, and starch mills operate little steam launches to draw their boats.

(*d*) There are no merchant vessels owned and operated by public authorities.

(*e*) There are no combinations or monopolies controlling towing. A suggestion has been made for a government monopoly of towing on the large shipping canal in course of construction between Berlin and Stettin, but the idea meets with vigorous opposition.

## V. Terminal Facilities.

(*a*) The most important inland terminals on the Oder are at Kosel, Breslau, and Kuestrin.

Kosel (Upper Silesia), the upper terminus of the large traffic, has three docks, the first opened in 1895, the second in 1903, the last in 1905. The first has a quay length of 450 meters (1,476.37 feet), to which 305 meters (1,000.65 feet) is being added.

Breslau has a municipal haven, covering 33.6 ha. (83.02 acres). Of the three docks planned only one has yet been built. It is 50 meters (164.04 feet) wide. The wharf length is 3,500 meters (11,482.9 feet). There are three large storehouses for grain, sugar, and fertilizers, an administration building, and a railroad station. The city powerhouse No. 2, near at hand, furnishes light and power.

(*b*) The most advanced methods are used at these havens for loading and unloading. Kosel's two new electric coal dumpers on the second dock protect the coal and can be operated also during high water. The first basin alone has 4 electric and 5 steam cranes and 6 old coal dumpers. The money has been granted for a new crane of 5 tons capacity. Breslau Haven has 22 cranes, 5 elevators, 3 spills, and 1 unloading apparatus for bulk goods up to 5 tons.

(*c*) The haven at Kosel has complete railroad connections. By working day and night it can transfer daily 12,000 to 13,000 tons of coal, over 500 tons of goods on the slides, and 3,000 to 4,000 tons with the cranes. The transfer in 1895 amounted to 10,700 tons, 927,000 tons in 1900, 1,570,000 tons in 1905, and 2,026,000 tons in 1908. It must be remembered that the average period of navigation between Kosel and Breslau is about 290 days.

The Breslau Haven has 2,000 meters (6,561.66 feet) wharf length with railroad connection and 1,500 meters (4,921.25 feet) without. The connection is complete with all roads.

(*d*) The terminals are owned by the Government, as in the case of Kosel, or by the city with state supervision, as in the case of Breslau and Neusalz. Private interests also own havens or loading places with the consent of the Government, and subject to its control; for example, that of the Frankfurter Gütereisenbahn-Gesellschaft, in Breslau and Frankfurt, and of Cæsar Wollheim, near Breslau.

## VI. Tolls and Freight Rates.

(*a*) Tolls are charged for passage through the canal and river locks. The elements considered in framing the tolls are the class of freight (usually four classes), kind of vessel, ownership, capacity (if empty), time (day or night), and preference. The toll is levied only on the cargo unless the boat is empty, then on the capacity. Vessels belonging to or serving the Empire or the State pass free. Passenger vessels pay according to the limit of passengers allowed by law. For passing boats outside of the regular hours or of the regular order of arrival, 50 per cent is added.

For example, on the upper Oder goods in the first class (such as cotton, coffee, fruit) pay 4 pfennigs, or 0.952 cent; in the second class (such as asphalt, lead, wool) pay 3 pfennigs, or 0.714 cent; in the third class (e. g., anthracite, cement, ice) pay 2 pfennigs, or 0.476 cent; and in the fourth class (e. g., brown coal, stone coal, oil cake, lute) pay 1 pfennig, or 0.238 cent, per metric ton of cargo carried.

(*b*) Towing rates at the entrance of the Oder-Spree Canal are prescribed by the Government under a contract with a steamer company, based on distance and loading capacity. Rates for horse towing on the Finow Canal (by the towing union) are based on distance and load. For example, towing into, on, or out of the Teltow Canal, one-half pfennig (0.119 cent) per ton of freight and kilometer (0.62137 mile) of distance, provided that the lowest fee collected shall not be less than the rate for empty vessels, which is, up to 250 tons capacity, 5 marks ($1.19), between 250 and 400 tons 10 marks ($2.38), and over 400 tons 15 marks ($3.57).

(*c*) The Oder system has regular schedules of freight rates, which vary with available boat space, state of the river, etc., and are published weekly in the newspapers during the season. Above Breslau the river is continuously navigable, though with occasional difficulties, about 290 days in the year; below Breslau traffic is stopped only by high water (when bridges interfere), floods, and ice.

The regular classifications of freight are coal, bulk goods, sugar, cereals, and package goods.

(*d*) Way stations pay for part loads a rate at least proportionate to the rate to termini.

The rate is proportionately smaller for whole loads. Coal is carried at a lower rate than bulk goods, sugar, and cereals, while the rate for package goods is higher.

For example, the rate for heavy package goods in lots of 5 tons or more (exclusive of all costs such as customs, insurance, unloading) in pfennig (0.238 cent) per 100 kilograms (220 pounds) varies about as follows during the year:

From Kosel to Berlin 70–90, to Stettin 50–80, to Hamburg 85–150; from Breslau to Berlin 50–70, to Stettin 28–60, to Hamburg 55–100.

The ordinary rate from Breslau to Berlin for this class of goods is 50–55, to Stettin 28–30, to Hamburg 55–65.

(*e*, *f*, *g*, *h*) The Silesian railroads were taken into government ownership mainly because they were disinclined to comply with the wishes of the minister of public works for a lowering of the rates.

As the Government owns the railroads and is developing the waterways, the theory is that the two should be made to work together for the general good.

On the question of railway rates ream after ream of paper has been consumed by shipping interests, producers, city authorities, and others who deemed themselves discriminated against; but whether the Staatseisenbahnverwaltung has or has not done the best possible in the circumstances is a matter for experts.

## VII. Water-Borne Traffic.

The traffic on the Oder system consists in general of such freight as does not require speedy delivery. The principal commodities transported upstream are fertilizers, ores, grain, oil seed, fish, flour, rice, oil, petroleum, tar, asphalt, bricks. Downstream come coal, ores, worked iron, barley, hardwood, soft sawed timber, mill products, railway sleepers, rye, potatoes (from the Warthe), sugar, molasses, sirup, stone, metals, quarry stones, bricks, and cement. The downstream movement is several times larger than the upstream.

Volume 179, Part I, of the Statistik des Deutschen Reiches, gives complete statistics of vessel movement and traffic on the Oder system for the last 10 years, with much other valuable information.

# RIVERS AND CANALS IN THE CONSULAR DISTRICT OF STETTIN.

Report by William C. Teichmann, *Consul.*

## I. Public Supervision.

(*a*) The Prussian Government exercises supervisory control over all navigable streams and canals in my district. All improvements are conducted by the Government along the water route, but at the various harbors of cities located on the route the respective municipalities often share with the Government the expense of the maintenance of the waterway, and in some instances the former will bear the entire financial burden of improvements. All work of this kind, however, is subject to supervision by the Government in accordance with the constitutional rights involved and termed "Staatliche Hoheits-Aufsicht." The same relation between Government and municipality obtains regarding the policing of all waterways. A board of 18 general councillors, "Gesammt-Wasserstrassen Beirat," with 6 subdistrict boards, conducts the general supervision.

(*b*) The Government or municipality is not connected with the navigation corporations, which are entirely private, and the capitalization of which is subject to the general corporation laws of Prussia and Germany.

There is no governmental or municipal regulation of freight rates. Competition between railways and waterways is unrestricted.

The president of the province (in this instance the president of the Provinz Pommern), called "Regierungs-Praesident," as the responsible head of the department of waterways, termed "Chef der Verwaltung von Wasserstrassen," supervises the collection of waterway statistics for presentation, at regular intervals, to the Government, which publishes them at its discretion. Much data relative to waterways, however, are also collected and published by municipal bodies of the cities located on the route.

## II. Waterway Improvements.

(*a*) There is no established policy as to water power developed by works constructed for improving navigation.

(*b*) For Prussia the established policy regarding improvements of waterways until 1900 has been for the Government to pay, by appropriation, one-third of the costs and to require the province through which the waterway passes and landed interests united in associations to cover the remainder of expenditures, including also the cost of maintenance. In 1900, on the occasion of high water

in the rivers of Silesia the Prussian Government conceded a more liberal participation of the State in this expense, and in 1904, when the improvement of the lower Oder and the Havel and Spree rivers, in connection with the projected waterway for 600 metric-ton boats from the Baltic Sea, via Stettin to Berlin, necessitated radical concessions on the part of the Prussian Government, the latter granted the payment of four-fifths of the amount required for this great improvement. In addition thereto the Government assumed the expense for the construction of all required buildings along the route, and also the larger part of the future cost for the maintenance of this waterway. In the bill introduced by the Government in the Prussian legislative body, called the "Landtag," it is stated expressly that this liberality did not commit the Government to the principle of assuming, as a rule, such a large percentage of the costs for waterway improvements, and it is there emphasized that only the exigencies incidental to the demand for a waterway of the kind projected for the route (Stettin-Berlin) had induced an exceptional deviation from the established policy of national disinclination to appropriate funds for waterways which should be principally furnished by the provinces and their shipping interests through which the respective water route passes or is to be conducted.

The present waterway connecting Berlin with Stettin has a length of 193.4 kilometers (120.172 miles), of which 85 kilometers (52.816 miles) are covered by the River Oder from Stettin to the town of Hohensaathen. For this section the above-mentioned bill designated an appropriation of 41,865,800 marks ($9,964,060), and for the rivers Havel and Spree connected with the projected waterway, 18,954,200 marks ($4,491,099).

The remaining section of the present waterway from Hohensaathen to Berlin is largely composed of the Finow Canal. This canal only enables water craft carrying less than 150 metric tons to pass through. Therefore another great improvement is to result in the floating of craft on an entirely new canal carrying boats with a capacity up to 600 metric tons (661.38 American tons) of freight. The cost of this improvement was estimated at 43,500,000 marks ($10,353,000), approximately for each kilometer (0.62137 mile), 435,000 marks ($103,530). The normal Oder barge, carrying 600 kilograms, which is to pass through the new canal, has a length of 65 meters (213 feet 3 inches), a width of 8 meters (26 feet 3 inches), and a draft of 1.75 meters (5 feet 7 inches) fully loaded. The dipped cross section of 8 by 1.75 feet corresponds technically to the canal cross section as 14:59 or 1:4.2.

A reduction in freight expense for the distance, Berlin-Stettin, as a result of the opening of the new canal is estimated by the Board of Trade for Stettin and Berlin, amounting to 70–75 pfennigs per metric ton ($0.1666 to $0.1785 per 1.102 American ton weight).

The annual figures for the traffic passing through the present Finow Canal average 1,000,000 metric tons (1,102,310.6 American tons). Governmental and Stettin Board of Trade calculations predict an immediate increase to 2,000,000 tons (2,204,621.2 American tons) and a steady growth subsequently because of increasing trade both ways.

The cities of Berlin and Stettin have agreed to contribute each one-half of the annual cost of the maintenance of the new canal, the figure of this yearly expenditure amounting to 655,000 marks ($155,890), and to cover one-third of the 3 per cent interest on the building capital of 43,500,000 marks, after deduction of revenue from the tolls and dues of the waterway.

The annual cost for the city of Stettin is estimated as follows:

| | Marks. | |
|---|---|---|
| Maintenance of canal, including expense of management and current repairs | 655,000 | ($155,890) |
| Interest on 43,500,000 marks, at 3 per cent | 1,305,000 | ( 310,590) |
| | 1,960,000 | ( 466,480) |
| Canal revenues | 1,310,000 | ( 311,780) |
| Annual expenses, total | 1,960,000 | |
| Revenue | 1,310,000 | |
| Deficiency | 650,000 | ( 154,700) |

Of this deficiency Berlin and Stettin would have to cover 216,667 marks, representing one-third; accordingly Stettin contributes 108,333.50 marks, and after deducting an annual contribution of 10,000 marks from the provincial government of Pommern, there would remain an annual amount of 98,333.50 marks ($23,403.37), which the city of Stettin would probably have to contribute to this great navigation improvement every year.

There is not much difference in the distance from Stettin to Berlin between the old and new route. The old Finow route has a length of 194.4 kilometers and the new route will be 186.2 kilometers (115.7 miles, English). The great benefit expected from the improvement is the cheapening of freight rates as already referred to, which is calculated to bring back to the Oder River and Stettin the formerly very important water traffic now diverted to the river Elbe by canal connections with this great German waterway and by corresponding Elbe River improvements. The trade between Berlin and Stettin by the Finow Canal route figured as follows during the years 1902–1906:

| | To Berlin. | | From Berlin. | |
|---|---|---|---|---|
| | *Metric tons.* | *Am. tons.* | *Metric tons.* | *Am. tons.* |
| 1906 | 927,286 | 1,022,157 | 309,606 | 341,282 |
| 1905 | 1,019,848 | 1,124,189 | 265,222 | 292,357 |
| 1904 | 1,050,849 | 1,158,362 | 241,863 | 266,608 |
| 1903 | 668,828 | 737,256 | 280,175 | 308,840 |
| 1902 | 654,758 | 721,747 | 259,621 | 286,183 |

The Chamber of Commerce (or Board of Trade, which are identical here) of Stettin estimates the following as the minimum traffic of the new waterway when opened in 1913: Stettin-Berlin, annual average 1,870,000 metric tons; and Berlin–Stettin, 700,000 metric tons. On April 1, 1905, the above-mentioned bill became a law and in addition to the already existing waterway (which furnished a water route from Stettin to Berlin for boats and barges not exceeding 150 metric tons (330,690 pounds avoirdupois) the construction of a new one for vessels carrying 600 metric tons (1,322,760 pounds avoirdu-

pois) has since been in progress. It will be completed in a few years. Its construction and subsequent management rests with one of the six subboards of Prussian waterway councilors, viz, that for the Grosschiffahrtweg Berlin-Stettin."

This board is composed of 25 members, the president (Regierungspraesident in Potsdam), his substitute, a high official entitled "Oberbaurat," two representatives each for the boards of trade at Berlin and Stettin, one for the boards of trade at Frankfurt on the Oder and Potsdam, one each for the Berliner Schiffahrtverein, the Pommerscher Binnenschiffahrtverein of Stettin, and the "Bund deutscher Schifferinnungen" in Fuerstenwalde on the Spree; two each for "Landschaftskammern," of the provinces of Brandenburg and Pommern, and the dike associations of Brandenburg and Pommern; one each for the provincial corporations of Brandenburg and Pommern, for the city of Berlin and for the city of Stettin. Every vacancy is immediately filled by a substitute already selected.

The Government provides all the experts required and has the right to carry out improvements and police the waterway independent of previous sanction by the board, but must subsequently inform the board of such action. All members are elected for three years. They receive remuneration for every day of the board's session to the amount of 15 marks ($3.57) per diem and traveling expenses (mileage). After the completion of this waterway it is contemplated to reduce this board in membership somewhat. The board is to meet at least once a year.

A detailed statement of the rights, duties, and privileges of this board is contained in the pamphlet published by the Royal Prussian Waterway Commission entitled "Bestimmungen betreffend die Wasserstrassenbeiräte, Zusammenstellung Mai 1908. Berlin, Gedruckt in P. Stankiewicz's Buchdruckerei."

## III. Floating Material.

(*a*) 1. Regarding the relative use of self-propelled vessels and towed vessels only tugs come into consideration for the former class and barges for the latter so far as the inland traffic on the river Oder from Stettin is concerned. The law now allows fleets of eight boat lengths of the size described above for certain sections and six for others. Fleets of a metric tonnage of from 2,500 to 3,000 are of frequent occurrence and are drawn by tugs of 200 horsepower with a draft of 1.50 meters (4.92 feet). On the river Oder stern-wheel steamboats having a draft of 1 meter only (3.3 feet) are also much seen. It is contemplated to run tugs through the new canal which have 500 horsepower and yet only a draft of 1.50 meters (4.92 feet).

2. The barges have no motor power and are drawn by the tugs above mentioned.

3. Size and draft of vessels are given above.

4. All the barges are of wood construction.

5. Cost could not be ascertained.

6. There is no difference in the type of the barges. There are closed and open barges, however.

7. The size of fleets is given above.

8. The type of the barges is the same in general, as they are all constructed for the 150-metric-ton limit of freight.

## IV. Ownership of Vessels and Business Organization.

(*a*) There are no waterway improvement companies that own and operate vessels. These are all owned either by shipping corporations of private character or by individuals. Innumerable barges are owned and run by those who operate them and join in fleets with others for certain trips up the Oder River. They are drawn by tugs furnished by the shipper at the starting point.

(*b*) Consolidations of vessel owners only occur occasionally. These are the "Fluss-Rhederei-Gesellschaften," incorporated as stock companies.

(*c*) Railroads do not own or operate river or canal boats or any of the vessels in my district. Industrial concerns do not own tugs or barges either. They sometimes contract on a large scale with the above-mentioned "Fluss-rhederei-Gesellschaften" or with individual owners of fleets of barges.

(*d*) No fleets are operated or owned by public authorities.

(*e*) Not in my district.

## V. Terminal Facilities.

(*a*) The striking features of the river and railroad terminals of the city of Stettin are the wonderful and model unification of both, with connections between both which could not be improved upon. The city a few years ago expended 18,000,000 marks ($4,284,000) on harbor and dock improvements. An exhaustive description of the technical features of these improvements is contained in the official publication prepared and issued by the municipal authorities of Stettin in 1906 and entitled: "Stettin als Handels-und Industrieplatz."

(*b*) I refer to the above-mentioned publication for the technical feature of loading and reloading vessels. Illustrations in this book give a good idea of the mechanical machinery used for said purposes, claimed to be of the most advanced European order.

(*c*) Railroad tracks do connect terminals, running close up to the docks so as to enable direct loading from railroad car to ocean steamer, river boat, or barge and vice versa. A belt railroad completing all connection has been added to the perfect system of terminal facilities.

(*d*) The terminals are owned partly by the city and partly by the Government, but largely by the former. No part of this system is owned by private parties.

(*e*) A list of dockage fees and other terminal charges could not be obtained. These charges are comparatively high but do not exceed the normal charges of other German ports.

## VI. Tolls and Freight Rates.

(*a*) Tolls are charged for canals and rivers. Tolls for the latter are paid at the harbors and are better termed harbor dues. They are municipal and cover the regular services connected with harbor traffic such as pilotage, lighterage, etc., and are based upon the cost of municipal harbor expenditures including these services, and also upon the cost of the maintenance of harbor improvements. There are 16

different classifications of such dues for the Stettin shipping traffic by waterway. A specified table is published in the above-mentioned book on Stettin, on pages 128–131. It will be seen therefrom that these dues are so high as to rank with the highest collected in other German ports. The reason for this policy is the enormous cost of the Stettin harbor improvements and the constant expense involved in the maintenance of the capacious free harbor "Freihafen" for inland shipping. An elaborate and technically minute account, with various illustrations from original photographs, is contained in the above-mentioned book on Stettin, relative to the construction of the Stettin harbor, the "free" port, quays, cofferdams, docks, terminals, cranes for loading and unloading, etc., and can be found on pages 49 to 120.

Regarding tolls exacted on this canal, the following table is given:

*Tolls paid for present canal (Finow Canal).*

[Distance, 105 kilometers.]

| | Pfennigs. | Marks. | Dollars. |
|---|---|---|---|
| Freight of Class I | 40 | 0.40 | 0.0952 |
| Freight of Class II | 32 | .32 | .07616 |
| Freight of Class III | 24 | .24 | .05712 |
| Freight of Class IV | 16 | .16 | .03808 |

This calculation is based on pfennigs per metric ton-kilometer, which would be:

| | Pfennigs. |
|---|---|
| Freight of Class I | 0.38 |
| Freight of Class II | .30 |
| Freight of Class III | .23 |
| Freight of Class IV | .15 |

*Tolls contemplated for new canal (as per governmental announcement).*

[Distance, 100 kilometers (62.137 English miles.)]

| | Pfennigs. | Marks. | Dollars. |
|---|---|---|---|
| Freight of Class I | 60 | 0.60 | 0.1428 |
| Freight of Class II | 50 | .50 | .1190 |
| Freight of Class III | 40 | .40 | .0952 |
| Freight of Class IV | 30 | .30 | .0714 |

This calculation is based on pfennigs per metric kilometer, which would be:

| | Marks. |
|---|---|
| Freight of Class I | 0.60 |
| Freight of Class II | .50 |
| Freight of Class III | .40 |
| Freight of Class IV | .30 |

It is calculated that the relative proportion of freight traffic in the new canal will be according to classification:

| | Per cent. |
|---|---|
| Freight of Class I | 19 |
| Freight of Class II | 15 |
| Freight of Class III | 6 |
| Freight of Class IV | 60 |
| Total | 100 |

Additional tolls, of very small importance, however, and yielding less than one-tenth of the amount collected as represented in above table, are exacted for locks and sluices principally, and also to a very small extent for empty vessels, tugs, passenger boats, rafts, small rowboats, etc.

The entire revenue expected annually from the new canal is figured by the Government at 900,000 marks, to which must be added, according to Government estimates, 410,000 marks revenue from tolls still collected from the old Finow Canal, which is to remain in operation for smaller craft, so that the total revenue of 1,310,000 marks ($311,780) is expected from 2,000 000 metric tons traffic in the new and 1.000.000 metric tons traffic in the old canal, equaling 2,204,621.2 and 1,102,310.6 American tons respectively.

There are no separate tolls collected for boats and cargo only empty boats or passenger boats paying toll as such.

(*b*) Towing rates are regulated according to the supply and demand for towboats. The larger the demand for some the higher the rates and vice versa. There is no Government control and competition is free to cut or raise rates, and since there is no agreement between the competing companies or individual owners tug rates fluctuate very much. These conditions only refer to my district, however, the conditions of which are alone under discussion in this report.

(*c*) Inland water lines do not have regular schedules of freight rates which are strictly adhered to. Rates are not stable and vary according to competition and supply and demand. At times when the traffic calls for plenty of vessels rates go up. Scarcity of barges for traffic on the lower river Oder from Swinemünde, the seaport of Stettin, down to Silesia, is not infrequent, and then when the shipping business slackens down again rates will drop considerably. Nevertheless I am able to give the following water-route rates from Stettin up the river Oder and thence by canal farther inland as normal and representing a fair average. They have been compiled by and checked up by the largest trading houses of Stettin and give a good idea of prevailing rates. Transportation in barges carrying 170 metric tons (274,782 pounds avoirdupois):

*Stettin to Berlin.*—Distance, 193.4 kilometers (120.172 miles, English) by water. Average rate at present for coal and for ore, varying from 24 to 30 pfennigs ($0.0571 to $0.07) per 100 kilograms (220.46 pounds avoirdupois).

For stone, same rates.

For fertilizers, per 100 kilograms (220.46 pounds), 30 pfennigs ($0.07).

For wood (lumber), per cubic foot, 6½ pfennigs ($0.0155).

For grain, per 100 kilograms (220.46 pounds), 26 to 28 pfennigs ($0.062 to $0.067).

*Stettin to Breslau.*—Distance, 350 kilometers by rail (217.48 English miles), water route transportation as above. Average rate at present for coal and ore, when in large shipments, 35 pfennigs ($0.083) per 100 kilograms (220.46 pounds).

For stone, same rates.

For wood (lumber), per cubic meter (35.26 cubic feet), 3 marks ($0.714).

For fertilizers, per 100 kilograms (220.46 pounds), 40 pfennigs ($0.095).

For grain, per 100 kilograms (220.46 pounds), 35 to 37 pfennigs ($0.083 to $0.088).

*Stettin to Cosel (Oderhafen).*—Distance, 485 kilometers by rail (301.35 miles), water route transportation as above. Average rate at present for coal and ore, 48 to 50 pfennigs ($0.1142 to $0.12) per 100 kilograms (220.46 pounds).

For stone, same rates.

For fertilizers, 60 pfennigs ($0.1428) per 100 kilograms (220.46 pounds).

For grain, 55 to 57 pfennigs ($0.13 to $0.1356) per 100 kilograms.

For wood (lumber), per cubic meter (35.26 cubic feet), 4 marks ($0.952).

(*d*) 1. Inland water rates are affected by distance of haul, the longer distance reducing the rate proportionately, viz:

*Stettin–Berlin.*—Coal rate per 100 kilograms, $0.0571 to $0.07. Distance, 120.172 miles by water and 84 miles by rail.

*Stettin–Cosel.*—Coal rate per 100 kilograms, $0.12. Distance, 301.35 miles by rail. Same relative rates for iron ore and stone.

*Stettin–Berlin.*—Fertilizer rate per 100 kilograms, $0.07.

*Stettin–Cosel.*—Fertilizer rate per 100 kilograms, $0.14.

*Stettin–Berlin.*—Grain, $0.062.

*Stettin–Cosel.*—Grain, $0.13 to $0.1356.

2. Quantity of commodity also affects the rates, larger shipments bring proportionately cheaper rates.

3. Speed does not affect rates. Mode and time of transportation are quite uniform, because fleets will go direct to destination and shipments are arranged accordingly.

4. Character of commodity influences rates in general so far as perishable and inflammable and other damageable goods are concerned, which call for a materially higher rate. For preferential rates commodities are divided into three "special tariff" classes (for rail and water routes):

*Class I.*—Manufactures and goods including such as raw sugar, paper, oil cakes, pasteboard, clay and lime articles, etc.

*Class II.*—So-called "halb-fabrikate," half-finished manufactures.

*Class III.*—Raw products and materials.

All seaports of Germany have preferential rates for certain commodities, principally for raw materials, by rail to inland points, which rail rates lower the difference between rail and water rates but do not bring the rail rates down to the low level of the water-route rates.

(*e*) Prorating arrangements do not exist between water lines and railroads, the former being private and the latter governmental; rate pools are out of question, as no laws exist which enable the Government to undertake such a regulation of rates.

(*f*) Inland water rates do not affect railway rates as yet, but there appears a desire on the part of government railway interests to strengthen the competitive power of the railroads against the growing competition of the waterways, which has resulted in decreasing the revenues of certain railroad lines particularly affected by the

canal legislation of Germany during the past decade. This movement is growing, and since it is based upon a material reduction of the State's revenue derived from the government railways, legislative action will either develop in the direction of acquisition of traffic control of the waterways by means of control of the canals, or if this traffic on the waterways remains financially too profitable to private interests "state" reasons will lead to legislation empowering the government railroads to "compete" with the waterways by preferential rates, with discretionary application in the interest of the railroad revenue.

Inland water rates competing with railway rates have not brought about any lowering of railway freight rates as yet, and the latter are not higher, comparatively, to interior nonwater points than to points also reached by the water route.

Comparing inland water rates with paralleling railway rates the following figures show that the former are lower than the latter:

*Stettin-Berlin, per 100 kilograms (220.46 pounds).*

[Distance, 120.172 English miles.]

| | Coal. | Iron ore. | Grain. | Fertilizers. |
|---|---|---|---|---|
| Water route | $0.0571 to $0.07 | $0.0571 to $0.07 | $0.062 to $0.067 | $0.07 |
| Railway | .10 | .08 | .1737 | .08 |

I have taken for comparison bulk freight, because this is the principal freight shipped by water line. Piece-goods freight goes by rail preferably because more quickly transported and delivered. It is asserted in some quarters that railway freight rates are lower for carload shipments than by waterway, but this does not appear from the data at hand, and for both short and long distances railway rates still exceed waterway rates in general. It must always be considered that the railway rates are of a fixed character determined by the "tariff commission," and are not capable of being adjusted to changing conditions, as the waterway rates are, unless said commission orders a revision.

(*g*) Notwithstanding the growing competition between rail and water lines, the railway interests have not thus far attempted any understanding with the water route or with private competing parties relative to said competition, and no agreements for the division of traffic have been proposed or even discussed as yet. Not one example of this kind has come to my notice, although I have made careful inquiries regarding same in my district.

(*h*) 1. No legislation is in existence regulating the relations between rail and inland water systems of transportation.

2. There is no governmental restriction on the lowering of rail rates in competition with water rates.

3. It is a general custom for the shipper to insure the merchandise, as the carrier need not assume the risk.

4. If, in exceptional cases, the shipper desires the carrier to cover the insurance the carrier can do this and, being at liberty to fix his rate, then will determine the rate, so that it includes the insurance.

## VII. Water-borne Traffic.

(*a*) The subdistrict of the province of Pommern under my immediate control, has only one navigable waterway, the river Oder. This river runs through the provinces of Pommern, Brandenburg, and Silesia, of the Kingdom of Prussia, into northern Austria. It connects Stettin and its seaport Swinemünde directly with a large number of important trade centers in middle and southeastern Prussia, such as the cities of Frankfurt on the Oder, in Brandenburg, and Breslau, in Silesia. Furthermore the Oder connects Stettin by water route of branch rivers and canals with various other large trade centers; for instance, Magdeburg and Dresden, on the River Elbe; Bromberg and Posen, in Eastern Prussia; and Berlin, by the Finow Canal, as already described.

Stettin is the largest Prussian port and the most important one of all the Baltic ports. Its trade with Scandinavia. Russia and Denmark is very large, and of formidable character also with Great Britain, Netherlands, Belgium, France, the United States and other countries, to which the distance has been materially shortened by the new ship canal connecting the Baltic with the North Sea. The excellent water-route facilities existing in Germany, together with the prospective opening of the new canal connecting the Oder and Stettin with Berlin for 600-metric-ton vessels, will increase the importance of Stettin as a great trading terminus by sea and inland waterway.

Regarding the relative proportion and character of the inland waterway traffic of Stettin, the year 1908 shows the entry of 916,211 metric tons of merchandise at this port, of which sugar alone represented nearly one-sixth, coal one-twelfth, grain one-fifteenth, coal briquette one-nineteenth, flour and foodstuffs one-nineteenth, zinc one thirty-fifth, lumber one fifty-fifth, and other articles following in still smaller percentages.

During this same period (1908) 1,616,086 metric tons of freight left the port of Stettin by inland waterway, of which coal represented nearly one-third, herrings one-seventh, ore one-eighth, boards one-fifteenth, other lumber one twenty-third, pyrites one twenty-sixth, petroleum one twenty-ninth (all of American origin), crude phosphate of lime (all of American origin) one thirty-first, paving stone one-twelfth, pig iron one twenty-fifth, cement one thirty-ninth, fertilizer one one-hundred-and-fifty-eighths (made from American phosphate of lime), and other commodities in smaller proportions.

By far the larger percentage of this freight was carried in bulk, the package freight being comparatively small. The herrings were all transported in barrels, however.

(*c*) As to the question whether local or other traffic predominates on the water route, it can be stated that the traffic, as described above, is predominately transit, in harmony with the character of a port like Stettin, although local manufacturing is growing and accordingly increasing its share in the above traffic steadily.

(*d*) To analyze the "typical conditions of labor employed in navigation and in terminal handling, particularly with reference to wages paid," presents a problem difficult to solve if reliable data are to be presented and true conditions to be described. I regret that

my sources of information have as yet not yielded satisfactory results in this respect.

The labor involved is of a variegated character. While the employees connected with the terminals in the cities are more permanently engaged and their wages regulated, much of the ordinary labor at the docks is "day labor," the wages of which are constantly fluctuating according to supply and demand. In regard to labor employed in navigation, similar conditions obtain. Here the wages paid show a wide variation, caused by the different classes and grades of labor accepted by the employers, similar to the scale in American ports, from the regularly working employee provided with papers of good record down to the roustabout taken temporarily for the lowest pay in the labor market.

The better class of dock and harbor labor in this port is organized, as in other cities, and endeavors to secure scales of wages fixed by the "union." Strikes are therefore not infrequent, although there is none on record here of recent date. The scarcity of labor existing during crop months in the agricultural districts does not appear in this city, and there is always plenty of supply on hand to fill the ordinary demands for navigation purposes, inasmuch as it is not organized, whereas terminal labor is controlled down to the dock laborers by the organizations.

# RIVERS AND CANALS IN BADEN.

Report by Ernest L. Ives, *Vice-Consul at Mannheim.*

## I. Public Supervision.

(*a*) The supervision over the Rhine and Neckar is by the Rheinbau Inspection of Mannheim. This extends for the Neckar as far as the boundary of Baden, and for the Rhine, over a certain district. This supervision is subject to a higher authority, that of the committee of waterways and streets at Karlsruhe.

(*b*) 1. There are no navigation corporations in this district. The department of interior has control of the rates that are paid out for towing on the Neckar. The Rheinbau Inspection has control of the reports of operation. Maintenance and improvement are controlled by the State.

## II. Waterway Improvements.

(*a*) In 1901 Baden, Bavaria, and Alsace-Lorraine entered into an agreement for the improvement of the Rhine, and in accordance with this agreement, the channel of the river is being deepened between Strassburg and Sonderheim, a distance of 114 miles. At the end of 1907 the depth of the channel at Maxau was 9 feet. The total cost of this undertaking is estimated at $3,204,451.

According to the agreement, Bavaria was to pay the sum of $190,000, and the remainder will be paid by Alsace-Lorraine and Baden. The city of Strassburg pays $166,600 of the cost to be met by Alsace-Lorraine, and Baden is to receive $238,000 from certain interests in Alsace-Lorraine.

(*b*) The expense of improving the Rhine has been borne by the States through which it flows, namely, Baden, Alsace-Lorraine, Bavaria, Hessen, Prussia, and the Netherlands.

For the year 1907 the cost was as follows:

| | |
|---|---|
| Baden | $125,843.21 |
| Alsace-Lorraine | 111,230.97 |
| Bavaria | 23,303.53 |
| Hessen | 50,401.02 |
| Prussia | 284,401.11 |
| Netherlands | 240,083.93 |
| Total | 835,263.77 |

The cost to the State of Baden was divided as follows:

*1. Maintenance.*

| | |
|---|---|
| 1. Maintenance of towpaths, banks, straightening and regulating the stream, including planting trees, etc | $22,270.93 |
| 2. Maintenance of channel (dredging and blasting, etc.) | 386.75 |
| 3. Removal of sunken vessels | 48.98 |
| 4. Construction supervision (exclusive of salaries, cost of soundings, maintenance of machinery, etc.) | 14,466.47 |
| Total | 37,179.13 |

*2. New construction.*

| | |
|---|---|
| 1. New banks and correction of streams | $12,332.99 |
| 2. Completion of work on banks and correction | 58,516.95 |
| 3. Additional construction for completion of correction work | 3,406.22 |
| Total | 74,255.16 |

*3. Protection of banks.*

| | |
|---|---|
| 1. Stonework along banks | 39.90 |
| Total cost for year | 111,474.19 |

III. FLOATING EQUIPMENT.

(*a*) The most prevalent type of boat is the side-wheeler steamboat. No boats with rear wheels are used. The screw tugs are used, but the greatest amount of freight is carried in barges drawn by side-wheelers. There are also screw steamers which carry freight.

1. The self-propelled boats are generally used for carrying freight and towing purposes. According to their uses, the boats were divided as follows:

| | Number. | Per cent. |
|---|---|---|
| Passengers or freight traffic | 69 | 6 |
| Passenger traffic | 87 | 7 |
| Freight traffic | 204 | 16 |
| Towing barges | 877 | 69 |
| Various purposes | 35 | 2 |

Steam is generally used for power. There are some small motor boats. In 1907 there were 10 in Baden. In Prussia there were 129 motor boats, with 1,355 horsepower, used on the Rhine. On the Rhine tributaries there were 27, with 356 horsepower.

2. Some barges are poled downstream, but this is exceptional, as they are usually towed.

3. The side-wheelers have a length of from 45 to 75 meters, width of from 5 to 20.5, and a depth of from 1 to 1.25 meters. The engines are from 100 to 700 horsepower.

The screw steamers have a length of from 45 to 80 meters, a width from 6.5 to 10, a depth of from 2 to 2.5 meters (when loaded), and the engines are from 350 to 650 horsepower. They have a cargo capacity of from 240 to 1,320 tons.

The barges are from 56 to 85 meters long, 6.7 to 11 meters wide, when loaded a depth of 1.75 to 2.5 meters, and a carrying capacity of from 450 to 1,700 tons.

4. Of the 9,262 barges and sailboats, 5,856 were iron, with a capacity of 3,025,720 tons, and 3,406 were of wood, with 531,946 tons carrying capacity. In 1896 the number of iron barges of more than 1,000 tons capacity was 277; in 1906 this had increased to 890, while the number of wooden barges of over 500 tons capacity had decreased from 17 to 6 in the same period.

Some of the largest iron barges are:

| | Length. | Width. | Depth. | Capacity. |
|---|---|---|---|---|
| | *Meters.* | *Meters.* | *Meters.* | *Tons.* |
| Richard IV | 102 | 12.6 | 2.75 | 2,615 |
| Leopold Marianne II | 100 | 12 | 2.75 | 2,340 |
| Rees | 102.5 | 11.6 | 2.75 | 2,286 |
| Mannheim 60 | 88.2 | 12.1 | 2.66 | 2,062 |

5. The cost of various types of boats are as follows:

BARGES.

| Tons. | Length. | Width. | Depth. | Cost. |
|---|---|---|---|---|
| | *Meters.* | *Meters.* | *Meters.* | |
| 200 | 43 | 6.2 | 1.2 | $4,712 |
| 300 | 46 | 6.65 | 1.6 | 6,235 |
| 400 | 54 | 7.5 | 2 | 8,639 |
| 600 | 56.5 | 7.6 | 2.1 | 10,329 |
| 1,000 | 67 | 9.1 | 2.3 | 13,780 |
| 1,200 | 76 | 10 | 2.2 | 15,279 |
| 1,500 | 85 | 10.4 | 2.5 | 17,063 |

STEAMBOATS—SIDE-WHEELERS.

| Horsepower. | Length. | Breadth. | Depth. | Cost. |
|---|---|---|---|---|
| | *Meters.* | *Meters.* | *Meters.* | |
| 800 | 68 | 8.2 | 1.2 | $76,000 |
| 1,000 | 75 | 8.6 | 2 | 85,000 |

SCREW BOATS.

| | | | | |
|---|---|---|---|---|
| 140 | 19 | 4.7 | 1.5 | $11,000 |
| 200 | 20 | 5 | 1.5 | 12,000 |

TWIN-SCREW BOATS.

| | | | | |
|---|---|---|---|---|
| 600 | 38.85 | 7 | 1.75 | $37,000 |
| 750 | 40 | 7.25 | 1.35 | 41,000 |
| 900 | 47 | 7.80 | 1.20 | 40,000 |

6. Barges are generally used for the transportation of coal, iron, ore, sand, wheat, lumber, stone, etc. Although in some cases goods are transported by large steamers.

7. The number of barges in a fleet vary according to the depth of the water and the power of the tug. The number carried in low water is usually three; high water, eight; and the average number is five.

8. The lowest depth with which traffic can be maintained by large boats is 1.3 meters. The boats are built with a view to utilizing high or low water.

## IV. OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

(*a*) There are some companies that own and operate vessels on the Rhine and Neckar, and among the most important of these are the following: Bad. Artiengef., E. Flaskamp, Heilbronner Schiffahrts-

Kommissariat, Rol. Küpper & Co., Rheinische Transport-Gesellschaft, William Egan & Co., etc., at Mannheim.

(*b*) There has been consolidation of companies, but not to any great extent.

(*c*) There are no vessels owned and operated by the railroad.

(*d*) There are no fleets or merchant vessels owned by public authorities.

(*e*) There are no monopolies to any extent.

### V. TERMINAL FACILITIES.

(*a*) There are harbors at Kehl, Karlsruhe, Rheinau and Mannheim. These have all been built by the State except the one at Rheinau, which was constructed by a private company, but under government control.

The harbors at Mannheim are the principal ones. These were first in use in 1840, but the increased traffic made a constant demand for more space and up to 1865 the cost had amounted to over $665,000. From 1865 to 1902, the total cost of harbors as well as railway stations and light and power equipment amounted to about $5,000,000.

In addition to these the city of Mannheim has constructed the "Industriehafen" at a cost of about $1,850,000.

The harbors in Mannheim have a wharfage of 25,500 meters, of which about 5,000 are masonry.

(*b*) There are 112 cranes, of which 62 are operated by steam; 49 are electric, and 1 hand crane.

(*c*) There are about 17 miles of railway tracks along the harbors and the facilities for transferring goods from boat to train are the very best.

(*d*) The river terminals are owned by public and private companies. However, the railroads own property in many cases where the tracks are laid.

### VI. TOLLS AND FREIGHT RATES.

(*a*) There are no tolls for the use of waterways.

(*b*) In the Neckar there is laid a chain from Mannheim to Heilbronn, having a length of 70 miles. This is picked up by tugs, over which it runs on wheels. These tugs have 110 horsepower and are able to draw upstream five to ten barges with a cargo of 300 tons each.

(*c*) The rates for carrying freight vary according to the stand of the water as well as the kind of goods. For the year 1908 the rates from Rotterdam to Mannheim for loads of from 600 to 800 tons were as follows:

| | Per 4,400 pounds. |
|---|---|
| January | $2.02 |
| February | 2.02 |
| March | 1.43 |
| April | 1.43 |
| May | 1.31 |
| June | 1.55 |
| July | 1.90 |
| August | 2.62 |
| September | 3.57 |
| October | 4.28 |
| November | 4.05 |
| December | 2.98 |

(*d*) 1. The distance has very little effect on water rates. For instance, the distance from Rotterdam to Cologne is 110 miles, and to Mannheim is 354 miles, but the rate on the same class of goods to Mannheim is but 48 cents more than to Cologne.

2. The rates vary according to quantity of commodity offered.

3. The rates also vary according to speed.

4. For boat loads of grain or coal the rate has been as low as 90 cents for 4,400 pounds, and as high as $2.68. The rate by rail for coal is $5.57 and for grain is $8.75 per 4,400 pounds. The distance from Rotterdam to Mannheim is 298 miles. The cheapest rate is for ore and sand, which is $2.43 per 4,400 pounds; for the highest class freight it is $17.95 for 4,400 pounds.

The rate for such goods as coffee, tobacco, rice, cotton, etc., in boats is from $2.14 to $2.86 per 4,400 pounds.

The rates for freight on passenger boats are: Small shipments, $5.70; shipments of 110,000 pounds, $5.42; shipments of 220,000 pounds, $5.14 per 4,400 pounds.

(*e*) There are no agreements between water tariffs and railway tariffs.

(*f*) The railway rates in no way affect the water rates.

(*g*) There are no agreements between rail and water lines in regard to division of traffic.

(*h*) There is no legislation regulating the system of transportation between rail and inland waterways.

There is no Government restriction in regard to the rail and water rates.

It is customary for the shipper to insure the goods, but this does not affect the freight rate.

## VII. WATER-BORNE TRAFFIC.

(*a*) The following list shows the most important goods handled and the amount of each:

| | Tons. |
|---|---|
| Coal | 6,904,164 |
| Iron ore | 5,742,049 |
| Earth, sand, etc | 3,638,063 |
| Wheat and spelt | 1,795,810 |
| Lumber | 799,667 |
| Barley | 449,593 |

The total amount of traffic on the Rhine for 1907 was 64,505,058 tons, an increase of 7.4 per cent over 1906. The amount in the German harbors on the Rhine in 1897 was 21,400,277 tons, and in 1907, 41,476,834 tons, showing that the traffic had almost doubled in 10 years.

Of the 41,476,834 tons carried, 28,937,168 tons were upstream and 12,593,666 tons were downstream. The amount at Mannheim was 6,095,924.

In 1907 there were 223 rafts, amounting to 45,181 tons, received at Mannheim. In 1896 there were 668, with a weight of 127,199 tons. These all came down the Neckar. The total traffic on the Rhine tributaries, Neckar, Main, Lahn, Mosel, Ruhr, and Spoy Canal, amounted to 3,195,971 tons in 1907, and of this amount 2,197,827 tons were from the Rhine to the tributaries.

During 1907 there were 79,918 boats passed the German boundary on the Rhine, of which 57,225 were sailboats or barges. The number of unloaded barges was 13,757, or 24 per cent. The number of boats leaving Strassburg and Kehl, the head of navigation on the Rhine, were 1,758, of which 598 were steamboats. The number leaving Mannheim and Ludwigshafen, the head of navigation for large boats, was 25,873, of which 7,680 were steamboats.

There were 1,217 passenger boats and 18,886 steam tugs passed the boundary at Emmerich, carrying 792,437 tons cargo. The passenger boats also carry freight. The 79,918 boats of all kinds passing the border carried 23,188,956 tons of freight.

Of the steamboats, 65 per cent were German, 27 per cent Hollandish, and 8 per cent Belgian. Of the sail and barges Germany had 50 per cent, Holland 34 per cent, Belgium 15 per cent, and other countries 10 per cent. In 1907 the number of boats had increased to 11,156. Of the 1,272 steamboats in 1907, 169 were of the wheel type, with 106,515 horsepower, and 1,103 were screw boats, with 175,278 horsepower.

(*d*) The ordinary day laborers receive about 10 cents per hour, and are subject to discharge at any time. Sailor laborers receive $5.71 per week, and are subject to discharge at the end of the month. They provide for their food, clothes, etc. Men working at the cranes receive 35 marks ($8.33) per week, and are subject to discharge at the end of the month.

# RIVERS AND CANALS OF THE UPPER RHINE DISTRICT.

Report by WILLIAM I. PIKE, *American Consul at Kehl, Baden.*

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The navigation of the upper Rhine is of great importance to the commerce of this consular district, inasmuch as the industries of Alsace-Lorraine and Baden, especially the coal and iron industries, must depend to a great extent upon the transportation facilities furnished by the upper Rhine.

The press and public have awakened to a realization of the importance of making the Rhine as navigable as possible, and it may be but a few years before even Switzerland will be connected by an inland waterway with the North Sea ports.

An inspection tour was recently arranged by the ministry of Strassburg for the purpose of noting the progress of the work involved in the deepening of the Rhine. Although the success of this undertaking is by no means assured, certain distances have been made navigable, so that the completion of the undertaking is considered probable by means of modern engineering methods. A short distance of about 10 kilometers (6.21 miles), near Drusenheim, has thus been regulated, and it was this stretch which the inspection committee was particularly interested in.

It has for some time been evident that the industries of this consular district depend to a great extent upon the success in making the upper Rhine navigable. The ministry of Strassburg, in 1893, considered this question and referred it to the neighboring States of Baden and Bavaria. These States preferred a canal from Ludwigshafen, near Mannheim, to Strassburg, which has also been agitated by the local chamber of commerce, but the immense cost of such a canal makes it almost impracticable.

In the year 1901 an agreement was made among the States of Baden, Bavaria, and Alsace-Lorraine, the same being approved by their respective legislative bodies, according to which the cost of deepening the Rhine between Strassburg and Mannheim was to be divided as follows, the entire cost being estimated at 13,500.000 marks ($3,213,000): Bavaria to pay 800.000 marks ($190,400), Baden 40 per cent, and Alsace-Lorraine 50 per cent; the city of Strassburg 1,000,000 marks ($238,000), and the "Rheinische Kohlenkontor" (Rhine Coal Company) 700 000 marks ($166,600).

The stream must be so regulated that it will have a depth of at least 2 meters (6.56 feet) and must have a width of at least 88 meters (288.71 feet). If this undertaking, which was begun last year, should be successful, the Rhine will be made navigable between Strassburg and Mannheim for a period of 353 days of the year, instead of about 128 days, as is the case at the present time.

One great obstacle in the success of this engineering feat is the amount of quicksand and sand bars which are washed into the channel of the river.

It is estimated that the completion of this work would require no less than fourteen years, and the final cost of the same will amount to considerable more than the original claim of 13,500,000 marks ($3,213,000).

The freight boats at present can not go farther south than Strassburg, and special efforts are now being made to deepen the channel between Strassburg and Basel, thus giving water facilities to Colmar and Mülhausen, two important manufacturing centers of upper Alsace which are already reached by the Rhine-Rhone canal system.

The distance between Strassburg and Basel is 125 kilometers (77.63 miles), which stretch was navigable only from the last of April to the second week in July during 1907.

It is a noteworthy fact that the Rhine has a much larger stream of water during the summer months than in the winter time. The past summer the railroad bridge at Kehl on account of the high-water mark could not be passed by boats with a height of more than 11½ feet above water surface.

According to the Strassburg Chamber of Commerce the average time for a freighter down the river, according to tests made during the year, was about six hours, while the time consumed in going up to Basel was about twenty-four hours, and further, that there were ten such trips made in each direction.

During the coming spring improvements in wharf facilities will also take place. The landing place at Basel is to be enlarged and the one at Strassburg is now undergoing repairs, while the coal and iron industries of Metz will demand a better wharf at that point.

To the immediate section affected the importance of the deepening of the Rhine can not be overestimated, as it assures splendid water transportation facilities for this great industrial southern Germany.

During the past year two most important developments have occurred in the improvement and navigation proposition of the upper Rhine.

The first is the now demonstrated success of the engineering feat to overcome the quicksand and sand bars that constantly change the channel of the river and make extensive shipping impossible. The second is the confirmed statement that Switzerland, Alsace-Lorraine, and Baden will take up the project of making the Rhine navigable for the 77 miles between Strassburg and Basel by the same methods now used in deepening the Rhine between Mannheim and Strassburg.

At the time of the consummation of this project of deepening and making the upper Rhine navigable it was agreed that the maintenance of improvement should be provided for by the adjoining States.

For the improvements thus far made between the cities of Mannheim and Strassburg, a distance of 131 kilometers (81.40 miles), the latest available figures show that the States of Alsace-Lorraine and Baden each expend in maintenance of the Rhine improvements about 600,000 marks ($142,800) annually.

The State of Alsace-Lorraine, which is included in this consular district, has 413 kilometers (256.63 miles) of canals which are main-

tained by the State at an annual cost of about 350,000 marks ($83,300). An additional average expenditure is also made each year for the improvements, amounting in round numbers to 173,000 marks ($41,174).

While this consular district, which includes the territory of Alsace-Lorraine and the Grand Duchy of Baden, enjoys the advantage of transportation facilities by railway, river and canal, the character of the goods shipped by each makes a comparative statement of rates of small value.

The only subject of interest as to rates and water transportation on the river Rhine is from the city of Mannheim to Strassburg, a distance of 143 kilometers (88.86 miles), this being the only river route of any importance in this district.

The traffic on the river Rhine between the above-mentioned cities consists chiefly of coal, wood, flour and cereals, amounting last year to nearly 1,000,000 tons.

The freight rates for the foregoing articles, which constitute 90 per cent of the shipments in bulk, are from 1.70 marks (40 cents) to 2 marks (48 cents) per ton, and for piece or case goods from 2.50 marks (60 cents) to 4 marks (95 cents) per ton. It is well to add that the season for river traffic is only from April until August, that time being the period of high water.

Considering next the canal system, which ranks next to the river in importance as a carrier, the rates of transportation for coal, wood, flour and cereals, which also constitute the great bulk of goods transported, are as follows in bulk:

Strassburg-Colmar, 66 kilometers (41 miles), 1.60 marks to 1.80 marks (38 cents to 43 cents) per ton.

Strassburg-Mulhausen, 107 kilometers (66.49 miles), 1.80 marks to 2.20 marks (43 cents to 52 cents) per ton.

Strassburg-Metz, 155 kilometers (96.31 miles), 2.40 marks to 2.60 marks (57 cents to 62 cents) per ton.

Strassburg-Saarbruecken, 116 kilometers (65.87 miles), 2 marks (48 cents) per ton.

Piece goods are only shipped on the canal Strassburg-Colmar-Mülhausen:

From Strassburg to Colmar, 3.50 marks (83 cents) per ton—41 miles.

From Strassburg to Mülhausen, 5 marks ($1.19) per ton—66.49 miles.

The treatment of railway rates in any other than a general way is impossible, as the German system is perhaps the most complicated tariff in Europe, and the same can only be understood with the aid of the tariff volume, a special tabulation of 562 pages.

The railway freight tariff is first divided into four general classes:

I. Piece goods.
  (*a*) Slow freight.
  (*b*) Express.
II. General carload lots.
III. Carload lots (special tariff).
IV. Carload lots (exceptional tariff).

A further special classification is given goods under these general divisions—i. e., goods light in weight requiring much space; goods

inflammable or explosive, requiring special care; and shipments of goods that must have attention by employees en route to their destination, etc.

As previously stated, there is a general and special tabulation and classification under the four chief divisions, but for general information as it is, the freight rates are per 1 ton for 100 miles in Alsace-Lorraine:

Piece goods: Fast freight, 37.20 marks ($8.85); slow freight, 18.60 marks ($4.43).

General carload lots: 5-ton lots, 64 marks ($15.23); 10-ton lots, 109 marks ($25.94).

Special tariff carload lots: Raw material, 10-ton lots, 42 marks ($10); fertilizer, 10-ton lots, 38 marks ($9.04); road material, 10-ton lots, 30 marks ($7.14); cereals, 10-ton lots, 66 marks ($15.71).

For the purpose of comparison, to cover the only class of goods that are carried by the three mentioned competing systems, the following are the freight rates by railway from Mannheim to Strassburg, distance 143 kilometers (88.86 miles):

| | Per ton. | |
|---|---|---|
| | Marks. | Dollars. |
| Wood | 4.30 | 1.02 |
| Coal | 3.80 | .90 |
| Cereals | 7.10 | 1.69 |

It can be said that on the Rhine at this point there are no tolls or other charges for the use of waterways, and it is pertinent to observe that the law proposing tolls met with such strong opposition from industrial circles, commercial bodies, and chambers of commerce, that the scheme has, for the present at least, been abandoned.

The amount of water-borne traffic is steadily increasing on the part of the Rhine that is navigable, and the same is also true of traffic on the canals.

The freight on the upper river consists chiefly of coal, cereals, and oil, which for the year 1908, combined, amounted to 744,760 tons, and for the same class of freight and same year the tonnage on the canals in the district amounts to 354,399 tons.

The prevailing channel depth of the river Rhine varies according to the season of the year from 1 meter (3.28 feet) to 3.50 meters (11.48 feet), the highest water being during the summer months. The most important canals have a depth of 2 meters (6.56 feet) and a width at the bottom of usually 10 meters (32.81 feet) and at the surface 14 to 16 meters (45.93 to 52.49 feet).

As to the type of river boats coming to Strassburg the length varies from 70 to 98 meters (229.66 to 321.52 feet), the keel depth 1.75 to 2.40 meters (5.74 to 7.87 feet), and the width amounts to 9 meters (29.53 feet). The boats on the canals are, on account of the size of the locks, prescribed as follows: No boat should be longer than 38.50 meters (126.31 feet) on the principal canals, and the width is allowed to be 5.10 meters (16.73 feet) and the depth of boats to be not more than 1.80 meters (5.90 feet). The height of boats should not be more than 3.50 meters (11.48 feet).

The method for the propulsion of freight river boats is by accompanying steamer, side wheelers, with a capacity of moving three or four freight boats. There are also a few screw steamers in use. The boats on the canals are only moved by horses, as no steam power is allowed on the same.

For the loading and unloading of freight at terminals, good provision is always made—electric cranes are usually installed by the city and large companies and are of the most modern and improved type.

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## Addenda.

### WATERWAY IMPROVEMENTS.

Regarding the method used to overcome quicksand and sand bars in the river Rhine, it may be observed that the methods are identical with those now in use in the United States. The fascines consist of heavy stones, and large bundles of brushwood which are bound together with wire and are sunk into the water and built out from each shore in the form of piers to the proposed channel and to a special height.

These fascines are constructed at a distance of from 200 to 300 meters apart, and it has been demonstrated that the currents carry and deposit the quicksands into these sections, leaving the channel free.

### FLOATING EQUIPMENT.

(1) See page 160, last paragraph. Self-propelled vessels are not usually loaded with freight so far as the upper Rhine is concerned. They are used only to tow barges.

(4) The modern boats are usually constructed of iron.

(5) To use the commercial expression, the cost of steamboats (side wheelers) is usually from 250 to 300 marks per horsepower, and these steamers generally have from 750 to 850 horsepower. Screw steamers, which only come to Strassburg during an exceptionally high stage of water, cost about 200 to 260 marks per horsepower, and barges cost about 50 to 55 marks per each ton loading capacity.

(6) On the river Rhine at this point there is only one type of boats. On the canals, boats are built of wood, as described above, and are generally all of the same type.

(8) There are no special type of boats for low-water stage. When the stage of the river is low the boats are loaded accordingly.

### OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

(*a*) Most of the canal boats are owned by private persons and the family lives on the boat. Large factories have their own canal boats, which are operated only for their own use. Example: The sugar factory of Franckenthal has its own boats running on the canals.

(*b*) On the river Rhine there are two large steamship companies of this character: The Vereinigung von Spediteure und Schiffer, con-

sisting of small shipping firms working together, and the Co-operative Shipper Vereinigung at Rotterdam. Besides these, 31 share companies take part in the shipping traffic of the river Rhine.

(*c*) Vessels are not operated by railroads. The coal firms of Westphalia have their own boats, as well as the Standard Oil Company, whose ships come as far up the Rhine as Strassburg.

(*d*) No.

(*e*) No.

TERMINAL FACILITIES.

(*a*) No special features.

(*b*) Electric cranes with self-catcher are mostly in use.

(*c*) Yes. The harbor of Strassburg has direct connections with the main railway lines and tracks are located on wharves to permit direct transfer of goods between the cars and the ships.

(*d*) The terminals are owned by the city.

TOLLS AND FREIGHT RATES.

(*a*) No tolls are charged on the river Rhine. (See above, p. 159, par 3.) There exists, however, a toll on the canals of Alsace-Lorraine amounting to 0.18 pfennig per ton per kilometer, but there are no charges whatever for passing through locks, etc. In exceptional cases ships are allowed to pass at night and in this case extra charges are made to pay the lock men.

(*b*) There exists no special tariff for towing boats on the river Rhine; the charges differ very much and are governed according to the demand. Towing charges are low when many ships are not in use—the average charge for towing loaded barges on the river Rhine between Mannheim and Strassburg, a distance of 131 kilometers, is 90 pfennigs per ton. For towing empty boats down the river from Strassburg to Mannheim, about 100 marks are charged.

(*c*) Yes; but the governing element is the demand for boats and the average tariff on the canals in Alsace-Lorraine is 1.40 marks per ton and kilometer.

(*d*) 1. The longer the distance the smaller the rate for 1 ton-kilometer.

2. Same as above.

3. The rates are affected by speed and increased rates are charged where special delivery is required.

4. See page 159.

(*e* and *f*) No.

(*g*) The general attitude of rail and water lines is friendly and severe competition does not seem to exist.

(*h*) Matter of government ownership covers this question.

WATER-BORNE TRAFFIC.

(*a*) See page 159.

(*b*) Not obtainable.

(*c*) Local traffic largely predominates.

# RAILWAY RATES, INLAND WATERWAYS, AND CANALS OF BAVARIA.

Report by THOMAS WILLING PETERS, *consul-general at Munich.*

Bavaria's geographical position as a manufacturing and commercial country is particularly unfavorable. The central and southern parts of the country, which are chiefly agricultural, with no considerable supplies of coal and iron of their own, are connected by the Danube with the agricultural countries on the middle and lower course of the latter, but for a long distance have only railway connections with the coal and iron districts of western and central Germany. The result is that in the main part of the country, with the exception of the yarn and textile manufactures of Augsburg, no large industries have been able to exist. It is one of the most important problems of Bavaria how these unfavorable commercial and industrial conditions may be improved. By a special treaty with Prussia, Bavaria has secured the navigability of the Main, a tributary of the Rhine, as far as the Bavarian town of Aschaffenburg. The plan is discussed to make the Main navigable as far as the city of Bamberg and thence to construct a canal navigable for large boats southward to the Danube.

This would make Bavaria the most important transit country of Europe, as it would secure a direct navigable route between the North Sea and the Black Sea, between the large industrial and mining centers of western Germany and the agricultural sections on the middle and lower Danube. The idea is promoted by many persons of great influence in Bavaria, but it is questionable whether it will be possible to obtain a sufficient water supply for carrying out the plan. The costs of transportation at present increase the price of coal in southern Bavaria by more than 50 per cent. The costs for the railway transportation of flour from Rotterdam to Munich in quantities of 10 carloads amount to 3.88 marks per 100 kilos. If sent by towing boat to Mannheim and thence by rail to Munich the costs are diminished to 2.45 marks per 100 kilos. They would be considerably smaller still if there existed a navigable waterway between the Rhine and the Danube. In case of consignments smaller than half a carload (5,000 kilos) the difference is nearly 3 marks.

Nearly all the Bavarian railways are owned and operated by the State. The freight rates on the various lines in general are the same, with the exception that on small side lines, with no large traffic of their own, the ordinary rates are increased by 20 per cent. This is a financial measure, as these lines, which have been built in the interest of small villages, as a rule yield no returns on the capital invested in them by the State.

Since the beginning of the present year the different German States have an agreement, according to which the cars and locomotives of

each single State are allowed to run on the tracks and be used by the railways of all the other States.

We may distinguish the following classes of railway freight rates:

1. Rates which are the same in all German States, and which are determined by a permanent freight rate commission, composed of representatives of the various German States who have railways of their own.

2. Special rates common to two or more German States, and made by special agreement between the respective governments.

3. Rates made by the Bavarian Government without a consultation of other German governments generally in the interest of commerce or industries.

The rates of the first class are as follows:

*Rates for 100 kilograms for consignments of less than 5,000 kilograms (one-half carload).*

| Distance. | *a.* Fast freight. | *b.* Ordinary freight. | *c.* Special rates of ordinary freight for certain articles. |
|---|---|---|---|
| | *Marks.* | *Marks.* | *Marks.* |
| 100 kilometers | 2.48 | 1.24 | 0.99 |
| 200 kilometers | 4.50 | 2.25 | 1.80 |
| 515 kilometers [1] | 9.48 | 4.74 | 4.32 |

[1] The maximum distance in Bavaria.

*Carload freight.*

| Distance. | General rates. | | Special rates. | | | |
|---|---|---|---|---|---|---|
| | I. | II. | I. | II. | III. | IV. |
| | *Marks.* | *Marks.* | *Marks.* | *Marks.* | *Marks.* | *Marks.* |
| 100 kilometers | 0.86 | 0.72 | 0.59 | 0.54 | 0.44 | 0.34 |
| 200 kilometers | 1.54 | 1.32 | 1.12 | 1.02 | 0.82 | 0.56 |
| 515 kilometers | 3.65 | 3.20 | 2.70 | 2.44 | 1.92 | 1.25 |

The rates of class *a* and *b* (fast freight and slow freight) are less for longer distances, the rates for class *b* (ordinary freight) being as follows:

| | Pfennigs. | Dollars. |
|---|---|---|
| From 1 to 50 kilometers | 11 | 0.026 |
| From 51 to 200 kilometers | 10 | 0.024 |
| From 201 to 300 kilometers | 9 | 0.021 |
| From 301 to 400 kilometers | 8 | 0.019 |
| From 401 to 500 kilometers | 7 | 0.017 |
| Over 500 kilometers | 6 | 0.014 |

The rates of class *a* (fast freight) are double the rates of class *b* (ordinary freight).

All the other classes of rates are determined absolutely according to distance, as follows:

For class *c* (special rates for small consignments) 8 pfennigs per 10 kilometers.

For carload freight:

| General rates. | | Special rates. | | | |
|---|---|---|---|---|---|
| I. | II. | I. | II. | III. | IV. |
| *Pfennigs.* 6.7 | *Pfennigs.* 6 | *Pfennigs.* 5 | *Pfennigs.* 4 | *Pfennigs.* 3 | *Pfennigs.* 2.2 |

Fast freight has the speed of an ordinary passenger train. If fast freight is sent by an express train the rates are doubled. In case of an entire carload of fast freight a reduction of about 30 per cent is granted. Carload freight may also be sent as fast freight, in which case the ordinary carload rates are doubled.

Fast freight is always sent in covered cars. There are special reductions of the fast-freight rates in favor of certain agricultural products, such as fruit and milk. In some cases this reduction equals 50 per cent.

The different rates in the general and special tariff for carload freights are based on the general consideration that certain articles of small value can not be sent for great distances and sold if the costs of transportation are not materially lowered. These special rates therefore have the purpose of securing the marketability and selling power of certain articles at distant places. This will become clear by mentioning some of the articles in each of three special-rate classes: Class I—hides, cereals, raw wool, zinc in plates; Class II—clay, paper and pasteboard if exported, hemp, jute, vegetables, asphalt; Class III—furniture of persons moving from one place to another, cement goods, tar, straw, stone, rags, brans, ores, sand, fertilizers, barrels.

Some articles have been put into the reduced special-rate lists to encourage industries or agriculture.

The same considerations which have led to the establishment of the special-rate classes for goods sent in quantities of not less than 5,000 kilos have also given rise to a special reduced commodity rate (rate *b*) for consignments of less than 5,000 kilos.

In consignments of less than 5,000 kilos the terminal charges, including loading and unloading, but exclusive of the delivery, are included in the rates. In the case of consignments of more than 5,000 kilos the terminal charges are not included in the rates and the terminal service is generally attended to, not by the railway, but by the addressee himself or by forwarding agents.

There is a special fee for small services, such as issuing bills of lading, etc. This fee per carload (10,000 kilograms) is as follows: Fast freight, 2 marks; slow freight, Class I, 2 marks; Class II, 1.2 marks (reduced rate); special rates 1.2 marks for all four classes.

Storage is charged at the rate of 0.04 pfennig per 100 kilos in open spaces and 10 pfennigs in covered places.

If the loading and unloading is attended to by employees of the railroad the work is charged for at the rate of 0.04 pfennig for 100 kilos.

### Independent Tariffs (Specially Bavarian).

We may distinguish two kinds of independent Bavarian tariffs: (*a*) The so-called exceptional tariffs made for reasons of internal

commerce; (*b*) the independent tariffs influencing the commercial relations to other German and foreign states.

(*a*) *Exceptional rates.*—The exceptional tariffs are all commodity or accommodating rates, varying according to the various articles included. In all there are more than twenty different rates in this class, among which may be mentioned the rates for raw materials, sugarbeets, fertilizers, ores, and sands. Some of them have the object of favoring industries or of insuring the sale of certain products which would otherwise be valueless. The exceptional rates become lower for greater distances.

The following may be given as examples of the exceptional rates:

| | Wood. | Raw materials. | Wood building material. |
|---|---|---|---|
| | *Pfennigs.* | *Pfennigs.* | *Pfennigs.* |
| 100 kilometers | 0.39 | 0.29 | 0.24 |
| 200 kilometers | .72 | .51 | .34 |
| 515 kilometers | 1.25 | 1.67 | .78 |

## Question I. Coal Rates.

Coal belongs to Class II of the exceptional tariffs. The rates apply only if coal is sent from railway stations where the mines are located. Coal sent from other stations is charged according to Class III of the special tariffs. The object of making cheaper rates for direct shipments from the mines is to do away with intermediate trade, which increases the market prices of the commodity.

Subjoined are rates for coal not sent from mining stations (Class III of the special tariffs) on ten different lines for various distances (tariff common to the various German States).

| To— | Augsburg. | | Freilassing. | | Hof. | |
|---|---|---|---|---|---|---|
| | Kilometers. | Marks for 10,000 kilos. | Kilometers. | Marks for 10,000 kilos. | Kilometers. | Marks for 10,000 kilos. |
| Amberg | 205 | 57 | 252 | 67 | 155 | 46 |
| Aschaffenburg | 303 | 79 | 475 | 117 | 287 | 75 |
| Fuerth | 251 | 67 | 292 | 76 | 204 | 57 |
| Lindau | 193 | 64 | 363 | 92 | 496 | 121 |
| Schweinfurt | 257 | 69 | 402 | 100 | 185 | 53 |
| Weissenburg | 85 | 51 | 288 | 75 | 219 | 60 |
| Wolnzach | 88 | 32 | 202 | 56 | 274 | 72 |
| Worringen | 93 | 33 | 263 | 70 | 392 | 98 |
| Zorneding | 85 | 31 | 119 | 38 | 341 | 87 |
| Zwiesel | 251 | 67 | 283 | 74 | 303 | 79 |

| To— | Nuremberg. | | Rosenheim. | | Munich. | |
|---|---|---|---|---|---|---|
| | Kilometers. | Marks for 10,000 kilos. | Kilometers. | Marks for 10,000 kilos. | Kilometers. | Marks for 10,000 kilos. |
| Amberg | 68 | 27 | 248 | 67 | 207 | 58 |
| Aschaffenburg | 192 | 54 | 427 | 106 | 366 | 93 |
| Fuerth | 161 | 47 | 289 | 76 | 248 | 67 |
| Lindau | 330 | 85 | 281 | 74 | 221 | 61 |
| Schweinfurt | 120 | 38 | 378 | 95 | 318 | 82 |
| Weissenburg | 53 | 23 | 206 | 57 | 145 | 44 |
| Wolnzach | 139 | 43 | 121 | 39 | 60 | 25 |
| Worringen | 226 | 62 | 181 | 52 | 127 | 39 |
| Zorneding | 222 | 61 | 38 | 16 | 27 | 13 |
| Zwiesel | 220 | 60 | 201 | 56 | 196 | 55 |

The following is a table of rates on coal from mining stations on 10 different lines for various distances (independent Bavarian rates, rate on raw materials). The same reductions are granted to coal sent from the mining stations of other German States into Bavaria (by special agreement):

| To— | Eichhofen. | | Hausham. | | Peissenberg. | |
|---|---|---|---|---|---|---|
| | Kilometers. | Marks for 10,000 kilos. | Kilometers. | Marks for 10,000 kilos. | Kilometers. | Marks for 10,000 kilos. |
| Augsburg | 154 | 41 | 116 | 33 | 91 | 27 |
| Bamberg | 151 | 40 | 315 | 76 | 291 | 71 |
| Bayreuth | 158 | 42 | 337 | 87 | 321 | 78 |
| Erlangen | 115 | 52 | 276 | 68 | 252 | 62 |
| Ingolstadt | 87 | 26 | 135 | 37 | 136 | 37 |
| Kempten | 226 | 57 | 94 | 28 | 157 | 42 |
| Regensburg | 13 | 13 | 192 | 49 | 193 | 49 |
| Schwandorf | 36 | 19 | 235 | 58 | 235 | 59 |

| To— | Schwandorf. | | Schwarzenfeld. | | Stockheim. | |
|---|---|---|---|---|---|---|
| | Kilometers. | Marks for 10,000 kilos. | Kilometers. | Marks for 10,000 kilos. | Kilometers. | Marks for 10,000 kilos. |
| Augsburg | 184 | 34 | 192 | 49 | 264 | 65 |
| Bamberg | 157 | 42 | 156 | 41 | 64 | 21 |
| Bayreuth | 103 | 30 | 95 | 28 | 79 | 24 |
| Erlangen | 118 | 33 | 117 | 33<br>24 | 103 | 30 |
| Ingolstadt | 117 | 33 | 125 | 35 | 244 | 61 |
| Kempten | 256 | 63 | 264 | 65 | 419 | 94 |
| Nuremberg | 24 | 28 | 94 | 28 | 127 | 35 |
| Regensburg | 43 | 16 | 51 | 18 | 224 | 56 |
| Schwandorf | | | 9 | 8 | 181 | 47 |
| Würzburg | 196 | 50 | 196 | 50 | 164 | 43 |

(*b*). *Independent rates* (*made for reasons of commerce with other German and foreign States*).—The following examples will give an idea how these are calculated: Coal to a distance of 350 kilometers, 2.2 pfennigs per kilometer and per 100 kilos; the distance in excess of 350 kilometers, a reduction to 1.4 pfennigs per 100 kilos per kilometer; that is to say, in a distance of 500 kilometers 350 kilometers are charged at the rate of 2.2 pfennigs, 150 kilometers at the rate of 1.4 pfennigs.

## Question II. Iron Ore, Stone, Lumber, Fertilizer, Grain.

Stone, from 1 to 100 kilometers, 2.7 pfennigs per 100 kilos and per kilometer; the distance from 100 to 200 kilometers, 1.7 pfennigs; from 200 to 300 kilometers, 1.6 pfennigs, as explained above. Road-building material, from 1 to 80 kilometers, 2 pfennigs; from 80 to 200 kilometers, 1.4 pfennigs. Fertilizers, up to 350 kilometers, 2.2 pfennigs; for the distance exceeding 300 kilometers, 1.4 pfennigs. Ores, from 1 to 217 kilometers, 2.312 pfennigs; for the distance exceeding 217 kilometers, 2.2 pfennigs. Iron, 2.8 pfennigs per 100 kilos per kilometer. Cereals, up to 102 kilometers, 4.5 pfennigs; for the distance from 102 to 400 kilometers, 1.43 pfennigs. Cereals from Bavarian stations to the German seaports, 4.5 pfennigs up to 102 kilometers; for the distance from 102 kilometers to 400, 1.43 pfennigs.

In the direction of Switzerland (to promote exportation), to the Rhine ports, to Württemberg, the rate from Bavarian stations is 2.6 pfennigs. To compete with Austrian grain going from Austria to Switzerland through Bavaria (transit commerce), 3.2 pfennigs are charged for grain coming from Austro-Bavarian border stations.

The rate on toys, an important article of Bavarian manufacture, from certain Bavarian stations to the Rhine ports and to the German, Belgian, and Dutch seaports, is 4 pfennigs (normal rate, 6 pfennigs). On iron and steel the normal rate is 4.5 pfennigs; export rate, 2.8 pfennigs.

The general object of these independent tariffs is to promote exports, to render the importation of certain raw materials for home industries cheaper, to obstruct foreign competition, to secure a cheaper transportation of fertilizers, and to attract transit commerce.

Subjoined are a few more examples:

In the case of fertilizers there is no discrimination between different lines, as these articles are chiefly imported.

Iron ore, normal rate, 2.7; reduced independent rate, 2.2 pfennigs; smelting work in Prussia and Saxony noncompetitive points and vice versa up to 100 kilometers, 1.9 pfennigs; from 100 to 190 kilometers, 1.5 pfennigs; for the distance exceeding 190 kilometers, 1 pfennig; between Bavarian and Saxo-Prussian competitive points, 2 pfennigs up to 50 kilometers; for the distance exceeding 50 kilometers, 1.8 pfennigs.

Stone, normal rate, 2.7 pfennigs; reduced independent rate, 2.2 pfennigs per 100 kilometers; to Bavarian stations and ports of other German States from 1 to 100 kilometers, 2.7 pfennigs; 100 to 200 kilometers, 1.7 pfennigs; 200 to 300 kilometers, 1.6 pfennigs; distances exceeding 300 kilometers, 2 pfennigs; to Austrian and Austro-Bavarian stations, 2.2 pfennigs (to promote exportation).

To these rates must be added the fee charged for switching the cars, for loading, and issuing the bills of lading. This fee in the case of independent rates is as follows per 10,000 kilos (carload): Coal (for exportation), 3.50 marks; stone, 6 marks (for exportation in certain cases, from 6 marks to nothing); fertilizers, 7 marks (for the distance in excess of 350 kilometers, 3.50 marks, to encourage direct importation from the seaports); iron ore, 3.50 marks, to stations of other German States, 6 marks; cereals, 4.50 marks. The normal fees in these cases are as follows: Coal, stone, fertilizers, 6 to 12 marks; iron ore and cereals, 6 marks.

We therefore have the following classes of freight rates in Bavaria:

*1. Freight rates in common with other German States.*

| | |
|---|---|
| Decreasing according to distance. | *a.* For consignments of less than 5,000 kilograms fast freight, ordinary freight, special rate for certain commodities. |
| Determined absolutely according to distance. | *b.* For consignments of more than 5,000 kilograms, two classes of general rates and four classes of special rates. |

*2. Independent rates.*

| | |
|---|---|
| Decreasing regularly according to distance. | *a.* Exceptional rates for internal commerce. |
| Decreasing or increasing regularly or irregularly according to distance. | *b.* Independent rates for commerce with other German or with foreign states. |

As to commodity rates, we may distinguish a commodity rate for fast freight (milk, fruit, etc.), for ordinary freight in consignments of less than 5,000 kilos and in carload assignments (Classes II, III, and IV of the special rates). The independent rates all are commodity rates.

## Chap. II.

### Rivers and Canals.

There are only two rivers navigable for larger boats in the principal part of Bavaria. The Danube from Passau to Regensburg, and the Main, a tributary of the Rhine, from Aschaffenburg to Kizingen. To these must be added the Rhine, which forms the eastern border of the Polahvat.

Public supervision on the Danube is exercised by the state offices for roads and rivers in the various places. The same applies to the Main and the Rhine. For the latter there exists, moreover, an international commission composed of representatives of the various Rhine States, viz: Prussia, Holland, Hessia, Baden, Bavaria, and Alsace-Lorraine.

The state offices for roads and rivers mentioned above are subordinated to the governments of the various circles or political subdivisions of Bavaria, which in turn have to report to the minister of the interior.

The canals of Bavaria are not important. There is a canal connecting the Main with the Danube for very small boats, but the traffic is entirely inconsiderable. The canal department belongs to the ministry of railways and commerce.

The navigable rivers and canals, as far as they are public, must be kept in proper state for navigation by the state government.

The statistics of river and canal navigation are collected and published by the Bavarian office of statistics in Munich.

So far there is no established policy as to water power developed by works constructed for improving navigation. But certain rules will probably be established in the near future.

Bavaria has spent considerable sums for river improvements, the total amounts being as follows:

| | Marks. |
|---|---|
| Rhine | 15, 400, 000 |
| Main | 17, 700. 000 |
| Danube | 22, 800, 000 |
| | 55, 900, 000 |

The ports and landing arrangements are the property of the State. Terminal works have been constructed on the Danube at Passau, Deggendorf, and Regensburg; on the Rhine at Ludwigshafen, Speyer, and Maximiliansau; on the Main at Aschaffenburg. There are no important cases of terminal facilities provided by private persons or companies.

The tracks of the railroads, which are all state railways, are always located so as to permit a direct transfer between railroad and water lines. The Bavarian ports on the Danube and Main contain no docks and wharves.

The costs of the terminal arrangements of the Danube ports are as follows:

| | Marks. |
|---|---|
| Regensburg | 2,400,000 |
| Passau | 800,000 |
| Deggendorf | 140,000 |

In the Danube the rocky channel of the river has been improved for purposes of navigation for a length of about 30 kilometers and adapted to low-water stage of 1 meter and 40 centimeters. The costs amounted to about 1,500,000 marks. The minimum water stage at which navigation is practicable for the ordinary boats is 1.3 meters.

Only paddle steamers are used. The steamers do not carry freight, but are used only for towing.

On the Danube there are three large private steamship companies—an Austrian company, a Hungarian company, and a specifically Bavarian, or, rather, South German company. The Bavarian state railways favor the latter by special reduced rates to the steamers of the Bavarian company in the Danube ports at Regensburg and Passau for assignments to the lower Danube countries—Roumania, Servia, and Bulgaria. The following table shows the difference between the ordinary rates from Munich to Regensburg and the reduced rates in favor of the South German steamship companies:

| | To Regensburg for further transportation to the lower Danube with the steamers of the above company. | To Regensburg without such further transportation. |
|---|---|---|
| Beer, cotton goods, preserves, soap, per 1,000 kilos: | *Marks.* | *Marks.* |
| In consignments of less than 5,000 kilos | 0.74 | 1.69 |
| 5 tons | .61 | 1.15 |
| 10 tons | .56 | .98 |
| Malt, per 100 kilos: | | |
| Consignments of less than 5,000 kilos | .74 | 1.69 |
| 5 tons | .61 | .84 |
| 10 tons | .56 | .77 |
| Paper: | | |
| Consignments of less than 5,000 kilos | .74 | 1.69 |
| 5 tons | .56 | .84 |
| 10 tons | .51 | .77 |

Railroad freight rates to water competitive points are not higher than to interior nonwater points.

There is consequently no active competition between railway lines and navigation lines. This will be clear from what has just been stated in regard to the measures taken to favor the South German Steamship Company. The following is a table of river rates in the Danube between Regensburg and Passau and on the state railway line parallel to the river:

| | River rate. | Railway rate. |
|---|---|---|
| | *Marks.* | *Marks.* |
| Cotton and cotton goods | 0.18 | 0.83 |
| Lumber | .20 | .53 |
| Cereals | .25 | .65 |

In case the goods are to be sent on at Passau to the Balkan countries with vessels of the South German Steamship Company, the above railway rates are reduced to 0.37, 0.28 and 0.41 marks, respectively.

If a very low water stage of the Danube obstructs navigation, the articles sent by ships from the lower Danube to the border port at Passau are sent on to their places of destination at reduced rates by the state railway.

The waterways in general have a greater competitive power than railways, especially in case of large consignments. But in Bavaria their competitive power is very limited in view of the unfavorable geographical condition mentioned at the beginning.

There are no tolls charged on Bavarian rivers and canals.

The quantity of commodities hauled on Bavarian rivers is not considerable, as there is no large industrial and commercial population in the vicinity of these rivers. The statistics for the three Danube ports for the last ten years are as follows (in tons):

| | 1899. | 1900. | 1901. | 1902. | 1903. | 1904. | 1905. | 1906. | 1907. | 1908. |
|---|---|---|---|---|---|---|---|---|---|---|
| Passau: | | | | | | | | | | |
| From Austria... | 69,695 | 72,720 | 97,352 | 87,960 | 77,554 | 52,792 | 74,336 | 87,009 | 16,790 | 68,756 |
| To Austria..... | 8,655 | 5,226 | 3,568 | 6,304 | 11,042 | 12,276 | 8,517 | 9,127 | 18,489 | 16,211 |
| Regensburg: | | | | | | | | | | |
| From Austria... | 101,346 | 127,702 | 134,094 | 107,713 | 139,089 | 111,793 | 157,829 | 160,908 | 163,743 | 98,616 |
| To Austria..... | 24,741 | 21,443 | 25,699 | 32,246 | 38,120 | 36,475 | 42,193 | 52,330 | 64,846 | 78,806 |
| Deggendorf: | | | | | | | | | | |
| From Austria... | 1,714 | 1,137 | 1,404 | 2,480 | 1,061 | 2,157 | 11,144 | ..... | ..... | ..... |
| To Austria..... | 725 | 1,664 | 2,144 | 3,684 | 3,319 | 2,316 | 2,769 | ..... | ..... | 1,138 |

The statistics for the water traffic of Würzburg, one of the Main ports, are the following (in tons):

| | Imports. | Exports. |
|---|---|---|
| 1902 | 2,942 | 5,436 |
| 1903 | 6,709 | 9,476 |
| 1904 | 7,751 | 11,061 |
| 1905 | 14,694 | 12,005 |
| 1906 | 16,400 | 17,636 |
| 1907 | 10,676 | 18,397 |
| 1908 | 12,871 | 22,575 |

The traffic of Bavarian Rhine ports above Ludwigshafen is much more considerable, averaging in imports and exports about 2,000,000 tons per annum.

The chief commodities transported on the Danube are cereals, wood and petroleum; on the Main, cereals, flour, wood and sugar.

Bavaria has no canal or other waterway improvement companies.

The chain-towing steamers on the Main, the steamship traffic on Lake Constance and a few other small lakes and rivers, and the vessels on the small canal mentioned before are owned and operated by the Bavarian state railway.

The towing rates in the Main are charged separately for vessels and cargo. The rates for vessels are as follows:

| Vessels with a tonnage up to— | Pfennigs per kilometer. | Vessels with a tonnage up to— | Pfennigs per kilometer. |
|---|---|---|---|
| 500 kilos | 3 | 60 tons | 44 |
| 3 tons | 7.7 | 75 tons | 48 |
| 5 tons | 12.8 | 100 tons | 56 |
| 10 tons | 16.3 | 125 tons | 62 |
| 20 tons | 21.4 | 150 tons | 68 |
| 30 tons | 27.2 | 175 tons | 74 |
| 40 tons | 32.4 | 200 tons | 80 |
| 50 tons | 38 | | |

And further for each additional 100 tons, 16 pfennigs per kilometer.

Up to a distance of 18 kilometers there are additional charges to these rates, as follows:

| | Per cent of the ordinary rate. | | Per cent of the ordinary rate. |
|---|---|---|---|
| Up to 4 kilometers | 50 | Up to 12 kilometers | 20 |
| Up to 5 kilometers | 45 | Up to 13 kilometers | 17.5 |
| Up to 6 kilometers | 40 | Up to 14 kilometers | 15 |
| Up to 7 kilometers | 36 | Up to 15 kilometers | 12.5 |
| Up to 8 kilometers | 32 | Up to 16 kilometers | 10 |
| Up to 9 kilometers | 28.5 | Up to 17 kilometers | 7.5 |
| Up to 10 kilometers | 25 | Up to 18 kilometers | 5 |
| Up to 11 kilometers | 22.5 | | |

Towing rates for cargo on the Main. The unit is 1 pfennig per ton per kilometer. Up to a distance of 32 kilos the following additional charges are made:

| | Per cent of the ordinary rate. | | Per cent of the ordinary rate. |
|---|---|---|---|
| Up to 4 kilometers | 40 | Up to 19 kilometers | 19.5 |
| Up to 5 kilometers | 39 | Up to 20 kilometers | 18 |
| Up to 6 kilometers | 38 | Up to 21 kilometers | 16.5 |
| Up to 7 kilometers | 37 | Up to 22 kilometers | 15 |
| Up to 8 kilometers | 36 | Up to 23 kilometers | 13.5 |
| Up to 9 kilometers | 34.5 | Up to 24 kilometers | 12 |
| Up to 10 kilometers | 33 | Up to 25 kilometers | 10 |
| Up to 11 kilometers | 31.5 | Up to 26 kilometers | 9.7 |
| Up to 12 kilometers | 30.5 | Up to 27 kilometers | 7.5 |
| Up to 13 kilometers | 28.5 | Up to 28 kilometers | 6 |
| Up to 14 kilometers | 27 | Up to 29 kilometers | 4.5 |
| Up to 15 kilometers | 25.5 | Up to 30 kilometers | 3 |
| Up to 16 kilometers | 24 | Up to 31 kilometers | 2 |
| Up to 17 kilometers | 22.5 | Up to 32 kilometers | 1 |
| Up to 18 kilometers | 21 | | |

The South German Steamship Company on the Danube has one general rate and two commodity class rates. Besides these there is a combined general and commodity class rate to certain Austro-Hungarian ports, a special commodity class rate to Austro-Hungarian ports, and a separate commodity class rate to ports on the lower

Danube (Servia, Bulgaria, Roumania). Finally, there is a special combined rate of the steamship company mentioned and the Roumanian state railways, for direct transportation between Bavarian Danube ports and Roumanian river railway stations.

For loading commodities from the railway cars into its boats the company charges 7 pfennigs per 100 kilograms for objects of transportation weighing not more than 100 kilograms. The charges for single freight of a higher weight is subject to special agreement.

All consignments are insured by the company itself up to a value of 120 marks for each 100 kilograms. If shippers send cargoes of a higher value and wish them to be insured for their entire value, the company charges additional insurance fees for the same in excess of the value of 120 marks per 100 kilograms.

*Freight rates of the South German Steamship Company from Regensburg.*

| Per 100 kilograms to— | General rate. | Commodity rate (A). | Commodity rate (B). |
|---|---|---|---|
| | *Marks.* | *Marks.* | *Marks.* |
| Vienna | 1.66 | 1.23 | 1.06 |
| Budapest | 2.59 | 1.96 | 1.66 |
| Belgrade | 3.71 | 2.48 | 1.96 |

| Per 100 kilos to— | Combined general commodity rate. Special rate to certain Austrian ports. | Special commodity rate. | Commodity rate to lower Danube ports. |
|---|---|---|---|
| | *Marks.* | *Marks.* | *Marks.* |
| Vienna | 0.77 | 0.64 | ..... |
| Budapest | 1.36 | 1.11 | ..... |
| Belgrade | ..... | 2.12 | 2.12 |

The reasons for establishing two special commodity rates coincides with those that led to the introduction of the special commodity rates of the state railways. The commodity rates to Austria and the lower Danube countries are export rates, which may be supposed to have been established under the influence and with the cooperation of the Bavarian Government.

The average wages of workmen in the service of the Bavarian Danube ports are about as follows: Mechanics (in the workshop), 5 marks; apprentices, 1 mark; day laborers, 4.25 marks per day.

# BAVARIAN WATERWAYS AND CANALS.

Report by GEORGE NICOLAS IFFT, *Consul at Nuremberg.*

## IMPROVEMENTS AND TRAFFIC.

River and canal navigation in the Kingdom of Bavaria presents few points of interest unless it be considered from the standpoint of representing types of what such navigation ought not to be. The Ludwigs Canal, which, by the way of the Main, connects the Danube and the Rhine and, theoretically, is the link completing an all-water highway from the Black Sea to the Atlantic Ocean, over which should pass the outgoing corn from the fields of Hungary, and the incoming raw material and merchandise for both Austria and Hungary, fails entirely in this purpose. It is antiquated in type and inadequate in extent. The traffic it carries is trifling and almost entirely local in character. The river traffic is of larger volume and more notable, but even that is inconsiderable. In no sense is there any competition between rail and water routes. The government owns the railroads and the canal; also the chain towing systems operated on the rivers and by its harbor, landing, warehouse and other fees practically controls all other river navigation. This fact entirely eliminates any question of real competition, and rates for both are regulated in accordance with the financial plans of the state ministry of transportation, or of the interior, as the case may be. As highways of traffic in Bavaria, the following water routes are to be considered:

1. The Ludwigs Canal, extending from Bamberg on the Main to Kelheim, near Regensburg on the Danube, a distance of 107 miles.

2. The Main, a chain towing system from Aschaffenburg to Würzburg and Kitzingen, a distance of 124 miles. This chain towing system is in course of extension from Kitzingen to Bamberg, a further distance of 71 miles.

3. The Danube, from Regensburg to Passau, a distance of 94 miles.

4. Lake Constance, and, for some purely local traffic, a few of the larger interior lakes of Bavaria, such as the Ammersee, the Starnbergersee, etc.

The Main and the Danube are open waterways. The Ludwigs Canal is the property of the Kingdom of Bavaria. Lake Constance is an international body of water, the traffic on which is operated jointly by the Bavarian and Swiss railway departments. As freight rates on the lake boats are fixed so that they will be just the same as those of the railroads for transportation around the lake, they are scarcely worth further consideration.

In Bavaria all river improvements for the furtherance of navigation are made by the government. Docks, wharves, freight ware-

houses, etc., are also all built by the government, but communities especially benefited are required to contribute a proportion of the cost commensurate with the special benefit derived. This is sometimes in money, sometimes a free site, or otherwise. The discretion of the ministry in such matters is broad. Tolls are charged on neither the natural waterways nor the canal, but there are fees for traversing the canal, for river towing, harbor fees, crane fees, warehouse fees, etc., and from these the government derives its revenues and makes effective its control. The theory of the Bavarian waterway laws is that the sum total of such fees must not exceed an amount sufficient to pay for maintenance, reasonable returns upon the investment in such improvements, and provide for the ultimate repayment of the original cost.

The control of canals is vested in the ministry of transportation, which also has control of the railroads, the telegraph, the telephone, the post-office, etc. All are parts of the same system for the forwarding of passengers, freight, express, mail, telegrams, and long-distance talking. Improvements of open rivers are under the jurisdiction of the ministry of the interior. There are no other navigation corporations in Bavaria proper, and therefore no capitalization of such, either controlled or uncontrolled. Some Austrian companies operate on the short stretch of the Danube between Regensburg and Passau, but, of course, subject to the Bavarian laws. Government regulation of freight traffic on both canal and rivers is exercised through the fixing of the fees for traversing the canal, the fees for the chain towing on the Main, as well as the harbor, warehouse, terminal, and other fees on both the canal and the Main and the Danube. The Government provides for maintenance and operation, and makes all improvements in channels, builds docks, cranes, terminals, etc. The Government publishes annually full and detailed reports of operations and improvements and statistics of traffic, which are included with the statistics of railway operations and in the various publications of the Bavarian statistical bureau and in the annual imperial statistics of inland water traffic.

There is no established policy as to water-power development or as to the improvement of navigation. There is, however, in existence an organization known as the Royal Bavarian Waterways Commission, the object of which is to keep before both Government and people the matter of river and canal improvements, study the needs and possibilities of such improvements, the possibilities of water traffic, and work out plans for the extension of the same. It is a semiofficial body and is doing most excellent work.

Attention is called to a publication entitled "A Memorial on the Improvement of Navigation on the Bavarian Danube and the Extension of Navigation from Regensburg to Ulm," by Eduard Faber.

This memorial presents an elaborate study of the Danube in Bavaria as a possible important highway of commerce, and is accompanied by a series of 28 statistical tables and eight elaborate drawings and maps. There are also two pamphlets by the same author, one entitled "On Inland Navigation Projects in Bavaria and their Economic Importance," and the other "On the Regulation of Erratic Flowing Streams at Low Water."

Attention is also called to a publication entitled "The Economic Value of Bavarian Water Highways," with a full and complete series of statistical tables, charts, etc., showing the relations of water routes and freight traffic, by Gustav Steller. The Report of the Ninth Annual Meeting of the Bavarian Waterways Commission, held June 5, 1909, is also important in this connection.

These publications illustrate the interest of the Bavarians in the creation of water highways and in securing the maximum benefits from waterways, which without the expenditure of large sums in improvements can scarcely be regarded as factors in the problem of transportation.

All canal work and river improvement is carried on by the Central Government, and, except as heretofore noted, at the expense of the Government. For example, for the Ludwigs Canal, from 1836 to 1859, the Government expended the total sum of $6,587,510. From the latter date until 1863, the operation of the canal showed a net surplus, but since 1863 there has been a regular annual deficit, running sometimes as high as $52,600. For the year 1908 the deficit was $23,700. These deficits are paid by the state and are regularly provided for in each budget. The maintenance of the canal (repairs), not counting the cost of management, called for an expenditure of $13,367.

For the chain-towing plant and improvements of the river Main the Government, up to the close of the year 1908, paid out a total of $1,462,000. Under enactment of June, 1894, an appropriation of $1,611,260 was made for this improvement. From the years 1898 to 1902 the Main traffic was operated at a loss to the Government, but since that time there have been annual net earnings varying from $3,000 to $12,000.

On the Ludwigs Canal the boats are towed by line, and to a small extent also on the Main. On the Main, however, most of the boats are towed by the chain-towing plant as far as Kitzingen. By exceptionally favorable water conditions, steam towboats can come as far as Würzburg. Downstream the boats, as a rule, float with the stream.

The canal boats are 98 feet long, 14.8 feet wide, and 3.6 feet deep.

On the Main the maximum dimensions of the boats are:

| | Length. | Breadth. | Depth. |
|---|---|---|---|
| | *Feet.* | *Feet.* | *Feet.* |
| Freight steamboats | 125 | 21.3 | 5.4 |
| Freight towboats | 213 | 26 | 7.2 |
| Sailboats | 269 | 33 | 7.9 |

On the canal the boats are all of wood. Most of the Main boats are also of wood. The Bavarian Government has, however, four iron canal boats on the Main, and recently several cement factories have placed iron boats on the river. These boats vary so greatly in type that even an approximate figure as to their cost is impracticable. The largest of them is a very small vessel. The iron coal boats of the Government cost $2,356 each. There was paid for the five tow chains, in 1898, $34,224; in 1899, $39,270; and in 1900, $41,222. Such

things as fleets of barges can not be said to exist. The type of boats on the canal and most of those on the Main, especially the iron coal boats, are constructed with a view to utilization at low water.

The towboats belong to individual shippers. Neither canal companies nor waterway-improvement companies own vessels, nor do such companies exist. There are no cases of consolidation of vessel owners for operating extensive fleets on these waters, nor are there any such fleets, aside from the few boats owned and operated by the cement manufacturers on the Main. The public authorities own or operate no merchant vessels, and there are no combinations or monopolies controlling towing on either canal or river.

The harbor facilities and appliances for loading and unloading are everywhere of the simplest nature, in many instances almost primitive. The main canal harbor is at Nuremberg, and there are harbors at Bamberg, Schweinfurt, Kitzingen, Ochsenfurt, Würzburg, and Aschaffenburg, and wood-loading stages at Staffelbach, Schweinfurt, Marktbreit, Ochsenfurt, Kitzingen, and Würzburg. At Kitzingen and Würzburg, especially, there are sidetracks permitting direct transfers of freight from river to railway and vice versa, but such connections exist to a greater or less extent at most other harbor points. All harbor and terminal facilities are the property of the State and are operated by the State.

### NAVIGATION FEES AND FREIGHT RATES ON THE BAVARIAN CANALS AND RIVERS.

Navigation fees proper—that is, charges for the traversing the waters—are, as heretofore noted, collected only on the Ludwigs Canal. These fees amount to 1 pfennig (about one-fourth of a cent) per kilometer (0.62 mile) for each metric ton (2,204 pounds) of freight moved. Empty boats pay no fees.

As already noted, the Ludwigs Canal has been operated at a loss for a number of years past, and under the present condition of the canal this situation is likely to continue indefinitely.

Towing charges on the Main for the government chain towing plant operated on that river were at first based upon the actual cost for the service, but in the course of time it was found necessary to readjust them for several reasons, but especially on account of the competition of towing with horses, which is slower and less certain but cheaper. Later various politico-economical reasons, such as a desire to assist smaller shipmasters in their efforts to do business on the river, were also taken into account in fixing the rates to be charged for towing.

"Regulations and Tariffs of the Government Chain Towing Navigation on the Main," in force since January 1, 1905, gives in the fullest detail examples of all possible combinations affecting towing fees and the regulations in regard to the same.

There are three navigation companies operating on the Danube that figure to some extent in Bavarian freight traffic, and that have regular freight rates and classifications. These are: (1) Erste K. K. Priv. Donau-Dampschiffahrts-Gesellschaft; (2) K. Ungarische Fluss- & Seeschiffahrts-Actiengesellschaft; (3) Süddeutsche Donau-Dampfschiffahrts-Gesellschaft.

As I am preparing this report I note that the Austrian Government is taking steps to take over the latter corporation and operate it as a government property.

Freight rates on the three steamship lines above referred to for the principal commodity brought by them into Bavaria—that is, for grain—are fairly stable, but rates on practically all other commodities, especially those exported from Bavaria, are extremely variable and almost every shipment might fairly be said to be subject to individual rating and classification.

Freight rates on the Danube, as well as on other waterways, are affected by the following factors: Distance of haul; quantity of goods—that is, whether single package, large quantity, or entire boatload, or whether single shipments or a series of shipments covering a fixed period of time; speed—that is, whether shipped by express or ordinary freight boats; nature of commodities shipped, whether dangerous or inconvenient to handle, interfering with other traffic, difficult to load and unload; character of packing—heavy or light, space occupied in relation to weight, etc.

These classifications are, however, so involved and goods are so frequently affected by two, three, or four or more of such factors and in such varied manner that the services of an expert are required to figure out the rate on almost every individual shipment. The numerous possible combinations of qualities and conditions affecting rates make it almost impossible to state any general rule under which freight rates might be calculated. For instance, according to the tariff of the Erste K. K. Priv. Donau-Dampfschiffahrts-Gesellschaft, the following characteristics of commodities are taken into account in determining the rate to be charged for shipments of goods by their express boats:

| Kind of goods. | If forwarded by express boats the regular freight rates are raised— |
|---|---|
| | *Per cent.* |
| All goods, except those mentioned below and very heavy goods | 100 |
| Blockading goods—that is, those likely to interfere with traffic | 200 |
| Ships and boats, because of the difficulties in loading and transporting | 300 |

On the Main freight rates are fixed practically for each separate shipment and under conditions existing at the time of shipment. The traffic is practically in the hands of forwarding agents, but the total is trifling.

Prorating arrangements between water lines and railroads—that is, joint rail and water tariffs—do not exist with regard to navigation on the Ludwigs Canal, the Main, or that part of the Danube which is within Bavaria—that is, the water route from Regensburg to Passau. The traffic selects one or the other route independently of the other or, if it uses both routes, they are treated independently.

With regard to shipments of grain up the Danube into Bavaria, a joint water and rail rate is in existence. The grain comes as far as Vienna or Passau by water and thence by rail. This, however, means an all-rail route in Bavaria.

As stated in the introduction to this report, the water routes of Bavaria are not competitive, and neither river nor canal traffic affects the freight rates of the railroads. A comparison of water rates with paralleling railway rates is therefore of little interest. The waterways are too short to give any effective illustration and, besides, comparisons are difficult because of the difference in classifications for rail and water freights. I give, however, the following two examples for what they are worth:

PASSAU TO REGENSBURG.

[1 kilometer (0.62 miles). 100 kilos (220 pounds).]

| *Railroad, 118 kilometers.* | *Waterway, 153 kilometers.* |
|---|---|
| Regular highest tariff, 34 cents per 100 kilos. | Regular highest tariff, 24 cents per 100 kilos. |
| Regular lowest tariff, 9 cents per 100 kilos. | Regular lowest tariff, 12 cents per 100 kilos. |

FRANKFORT-ON-THE-MAIN TO WÜRZBURG.

| *Railroad, 132 kilometers.* | *Waterway, 218 kilometers; average freight rates; down the river.* |
|---|---|
| Exceptional tariff, 11½ cents per 100 kilos. | Wooden boards, 6 to 7 cents per 100 kilos. |
| Exceptional tariff, 13½ cents per 100 kilos. | Grain, 7 to 7½ cents per 100 kilos. |
| Regular tariff, 21½ cents per 100 kilos. | Collective freight, 11 to 13 cents per 100 kilos. |
| Regular tariff, 17 cents per 100 kilos. | |
| Exceptional tariff, 19 cents per 100 kilos. | *Up the river.* |
| | Grain, 8 to 9½ cents per 100 kilos. |
| | Oils and fats, 11 to 13 cents per 100 kilos. |

The Bavarian water highways are a part and parcel of the government transportation systems. They complement each other and may, in certain instances, make possible lower rates on certain routes. It could not, however, be said that railroad rates would be higher if no water transportation existed. The Government is always in a position to see that its transportation lines are not injured by private undertakings. In a general way it may be said that the water routes are a distinct advantage to the railroads. The Main, for example, offers excellent facilities for the floating of logs and lumber to points where it can be handled by the railroads and, except for the Main, much Bavarian timber would never reach the Bavarian state railways.

The Danube is also hardly a competitor of the railways, so far as local Bavarian traffic is concerned, and with regard to the long-distance traffic, especially to Austria-Hungary and the countries along the lower Danube, it undoubtedly brings to the railroads more traffic than it takes from them.

Direct legislation in regard to the relations between rail and inland water highways does not exist and has, I believe, never been considered by the Bavarian legislature.

The Statistical Yearbook for the Kingdom of Bavaria, 1909, gives the total number of vessels in service as follows:

| | Steamers. | Other boats. | Total capacity. |
|---|---|---|---|
| | | | *Tons.* |
| On the Danube | 12 | 107 | 60,737 |
| On the Main | 2 | 226 | 29,408 |
| On the Ludwigs Canal | | 15 | 1,720 |
| On Lake Constance | 7 | 6 | 1,525 |
| On Bavarian lakes | 15 | 2 | 420 |

The total water traffic on the Danube and Main in Bavaria for the same year, in metric tons, was as follows:

| | Received. | Shipped. | Passed. |
|---|---|---|---|
| Regensburg | 118,990 | 79,645 | |
| Passau | 64,763 | 23,909 | |
| Aschaffenburg | | | 293,915 |
| Würzburg | | | 45,396 |

In addition to the above there were 323,000 tons of timber, etc., in rafts floated past Aschaffenburg on the Main.

The principal items were grain, wood, petroleum, and other oils, stone, ores, and clay.

The total freight moved on the Ludwigs Canal was 66,739 metric tons.

Very full and detailed statistics of water-borne traffic on the Bavarian water highways will be found in the volume "The Economic Value of Bavarian Water Highways," by Gustav Steller, secretary of the Royal Bavarian Waterways Commission. Other publications on these subjects, I will refer to generally only:

1. Statistics of the German Empire, the volume on Inland Navigation, issued by the imperial bureau of statistics.
2. The Statistical Yearbook of the Kingdom of Bavaria. See pages 171–174.
3. The Annual Report of the Chamber of Commerce at Regensburg, pages 19–20 and 136–141.
4. The Anual Report of the Chamber of Commerce at Passau, pages 35–40 and 82.
5. The Annual Report of the Chamber of Commerce at Würzburg, pages 118–128.
6. The Annual Report of the Royal Bavarian Railways Administration, pages 28–31, 205–212 and 225–228.

I desire to call especial attention to the fact that, in this report, I have dealt only with Bavaria on the Right of the Rhine and have not at all referred to the Pfalz, a segregated fragment of the Kingdom situated on the left banks of the Rhine, and remote from my district.

The Süddeutsche Donau-Dampfsciffahrts-Gesellschaft publishes rate sheets giving joint water and rail rates with the various transfer points along the Danube, from which any point I may have overlooked may be worked out.

This report has been prepared in compliance with circular instructions dated August 16, 1909, (File No. 17594).

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# RAILWAY FREIGHT RATES, INLAND WATERWAYS AND CANALS IN BELGIUM

REPORT BY

ETHELBERT WATTS

AMERICAN CONSUL GENERAL AT BRUSSELS

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WITH SUPPLEMENTARY REPORTS AND APPENDICES

WASHINGTON

1911

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# RAILWAY FREIGHT RATES, INLAND WATERWAYS, AND CANALS IN BELGIUM.

By Ethelbert Watts,

*American Consul General at Brussels.*

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This report is in answer to questions prepared by the National Waterways Commission and the Department of Commerce and Labor and transmitted to American consuls through the Department of State.

## Chapter I.

### QUESTIONS RELATING TO FOREIGN RAILWAY RATES SUBMITTED BY THE NATIONAL WATERWAYS COMMISSION THROUGH THE DEPARTMENT OF STATE.

I. Give 10 examples of rates on coal on different railway lines for different distances, with the following details:

(*a*) Give termini for each shipment.

(*b*) Give distances of each shipment, including in the list of 10 rates at least 3 rates for the maximum distance that coal is shipped.

(*c*) Give separately the terminal and transportation charge. (If this is not possible, make note of the fact that the two are combined.)

(*d*) State what service is covered by the terminal charge.

(*e*) State the class of rate into which the coal traffic falls; that is, whether the rate is a special or commodity rate or a normal class rate, and, if the latter, what class.

(*f*) Give all other facts concerning method of shipment which affect the rate, such, for example, as minimum carload weight or minimum train load, open or closed cars, fast or slow freight, and the like.

(*g*) If any of these rates have been given to encourage the development of any industry, state the facts.

II. Answer the above seven questions (*a* to *g*), quoting in each case 10 examples of rates on different railway lines for different distances for the following commodities: 1, iron ore; 2, stone; 3, lumber; 4, fertilizer; 5, grain.

III. Give 10 illustrations of special rates granted to export business on different railways for different distances, and answer in each case the questions propounded above for the coal traffic (*a* to *g*) so far as they are applicable to the export business. Make a statistical tabulation comparing these export rates with local rates between the same termini.

IV. Give 10 illustrations of rates charged by different railways for different distances on the highest grade of classified freight, that which, in many countries, corresponds to the express business of the United States, and answer in each case the questions propounded for the coal traffic (*a* to *g*).

V. Give 10 illustrations of rates charged by different railways for different distances on typical products included in the various categories of the regular freight classification, showing both carload and less than carload rates, and answer in each case the questions propounded for the coal traffic (*a* to *g*).

VI. Are the freight rates based absolutely on distance, or is the rate per ton-mile less for longer distances? Show, in the case of different commodities, at what distances the fall in the rate per ton-mile takes place.

## Chapter II.

### QUESTIONS SUBMITTED BY THE DEPARTMENT OF COMMERCE AND LABOR THROUGH THE DEPARTMENT OF STATE RELATIVE TO RIVERS AND CANALS IN FOREIGN COUNTRIES.

#### I. PUBLIC SUPERVISION.

(*a*) State what public authority, national, state, or local, exercises supervision in the different instances over navigable streams and canals.

(*b*) What are the powers and duties of such officials in regard to the following:

(1) Capitalization of navigation corporations.

Regulation of freight rates.

Reports of operation.

Maintenance and improvement of channels, docks, and terminal facilities.

(2) Collection of statistics of water-borne traffic, and by what agencies such statistics are compiled and published.

#### II. WATERWAY IMPROVEMENTS.

(*a*) Is there any established policy as to water powers developed by works constructed for improving navigation? Give illustrations.

(*b*) To what general extent have river improvements and the construction of canals been carried on by the central government, by local governments, and by private enterprise? Give typical and important illustrations of each. Describe any system of cooperation and contribution between the central government and local government in such works.

#### III. FLOATING EQUIPMENT.

(*a*) What is the general character of vessels used on rivers and canals?

(1) The relative use of self-propelled vessels and towed vessels.

(2) Motive power for barges and canal boats.

(3) Size and draft of vessels.

(4) The use of iron, steel, and wood in vessel construction.

(5) The cost of various types of boats.

(6) The use of special types of boats for particular cargoes and on different classes of waterways.

(7) The size of fleets of barges.

(8) Is the type of boats adapted to low-water stages, or are they constructed with a view to utilization in high water?

In each case specific information is desired showing the situation in typical instances rather than general statements of a summary character.

#### IV. OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

(*a*) Do canal companies or other waterway improvement companies own and operate vessels? Give examples.

(*b*) Are there important cases of consolidation of vessel owners into large corporations operating extensive fleets on inland waterways?

(*c*) To what extent are vessels owned and operated by railroads, or by producing and distributing concerns, such as coal, oil, lumber, ore, etc., fleets? Give examples.

(*d*) Are there any fleets of merchant vessels owned and operated by public authorities? Give examples.

(*e*) Are there important instances of combinations or monopolies controlling towing on canals and rivers? Give examples.

#### V. TERMINAL FACILITIES.

(*a*) What are the important or striking physical features of river and canal terminals, such as docks, wharves, piers, and floating wharf boats? Give illustrations and send photographs with this answer.

(*b*) Describe the most advanced methods of loading and unloading vessels on inland waterways, including the use of mechanical appliances.

(*c*) Are railroad tracks located on terminals of inland waterways, permitting direct transfer between railroad and water lines? Do such railroad tracks form a belt railroad, connecting all the railroads at a given port? Give examples.

(*d*) Are river and canal terminals owned by public or private interests? Are they owned at all by private railways? If so, give the important instances.

VI. TOLLS AND FREIGHT RATES.

(*a*) Are tolls charged on canals and rivers? If so, what elements are considered in framing them and what service do they cover? Are there separate tolls for boats and cargo? Give typical illustrations.

(*b*) What elements enter into the making of towing rates on canals and rivers? Give illustrations of towing charges and send copies of any tariffs or towing rates.

(*c*) Do inland water lines have regular schedules of freight rates and classifications of freight? Are the rates stable or do they vary frequently with traffic exigencies? Give illustrations.

(*d*) How are inland waterway rates affected by—

(1) Distance of haul?

(2) Quantity of commodity offered?

(3) Speed?

(4) Character of commodity?

Give illustrations on important waterways.

(*e*) Do prorating arrangements exist between water lines and railroads, and to what extent? Give illustrations and send copies of joint rail and water tariffs.

(*f*) How do inland water rates affect railroad freight rates? Are railroad freight rates to water competitive points higher than to interior nonwater points of similar distances? Give illustrations.

Compare inland water rates with paralleling railway rates for short and for long distances, giving specific illustrations which shall show whether waterways have greater competitive power in the one case than in the other.

(*g*) What is the general attitude of rail and water lines toward each other? Is there active competition or are there agreements for the division of traffic? Give examples.

(*h*) Is there any legislation regulating the relations between rail and inland waterway systems of transportation? Is there any governmental restriction on the lowering of rail rates in competition with water rates? Give examples.

(*j*) Is it customary for shippers of goods by inland waterways to insure them, or is the risk assumed by the carrier? To what extent does this affect the freight rate? Give examples.

VII. WATER-BORNE TRAFFIC.

(*a*) What is the general character of traffic on inland waterways? The principal commodities moved, the proportion and character of traffic moved in different directions, relative importance of package and bulk freight, etc. (This should be answered specifically for different waterways.)

(*b*) Send official publications giving, for the last 10 years, available statistics of vessel movement and traffic carried on inland waterways; also railroad traffic, tonnage, and ton-mileage.

(*c*) Taking important inland water routes, does local traffic or other traffic predominate, and in what general proportion?

(*d*) Give a concise statement of typical conditions of labor which is employed in navigation and in terminal handling, particularly with reference to wages paid.

NOTE.—The above questions were revised by the members of the National Waterways Commission.

## SUPPLEMENTARY REPORTS.

### CHAPTER III.

INLAND WATERWAYS, CONSULAR DISTRICT OF LIEGE.

(Report by H. Abert Johnson, consul.)

### CHAPTER IV.

CANALS AND INLAND WATERWAYS OF THE CONSULAR DISTRICT OF GHENT.

(Report by W. P. Atwell, consul.)

### APPENDICES.

# REPORT ON BELGIAN RAILWAY RATES, INLAND WATERWAYS, AND CANALS.

## CHAPTER I.

### Railway Rates.

In Belgium there are 4,623 kilometers (2,624 miles) of railways, of which 4,093 kilometers (2,294.7 miles) are operated by the Belgian Government and 530 kilometers (329.3 miles) by companies under the Government control. Fifty-six kilometers (34.7 miles) extend into adjoining foreign countries.

Railway freight rates in Belgium are made according to the distance and character of goods to be transported.

General and special rates and conditions governing the transportation of goods in the interior of Belgium are specified and detailed in two pamphlets, entitled "Recueil Officiel des Tarifs pour le Transport des Marchandises, etc., fascicule I and fascicule I[bis.][1] which give both the Belgian interior and international rates of freight. See also Tables No. 1, No. 2, and No. 3 appended to this chapter.

These conditions specify the reciprocal obligations of the carrier and public from the time goods have been delivered for transportation up to the time of delivery of said goods to the consignee.

#### QUESTION I.—COAL RATES.

For 10 examples of rates on coal for different distances, see Table No. 3, page 15.

(*a*) For termini for each shipment, see Table No. 2, page 14.

(*b*) For distances of each shipment, etc., see Table No. 3. The maximum distance to which coal is generally shipped is 350 kilometers (217.4 miles).

(*c*) It is not possible to give separately the terminal and transportation charges, which include all costs and expenses.

(*d*) There is no other service rendered by the railroad at the point of arrival but the delivery of goods in full carloads and the prompt notice of the arrival of the same.

(*e*) Coal shipped in carloads of not less than 10 tons is carried at the regular rate of the fourth class, tariff No. 3 (slow freight). See Table No. 3.

There are also special rates and conditions for coal shipments mentioned from pages 29 to 121 of the above-mentioned pamphlet, entitled, "Recueil Officiel des Tarifs, fascicule I[bis]," especially in tariffs 1, 2, 27, 29, 31, 32, 42, and 54. Nos. 6 and 31 give exceptional temporary rates.

[1] Issued for the State Railways, Jan. 1, 1904.

Special rates Nos. 1 and 2 may be applied for the shipment (exportation by sea) of coal, respectively of 10 and 50 tons lots. See Table No. 3.

Special rates Nos. 27, 29, 31, 32, and 42 may be applied only in certain specified cases. Special rate No. 54 is for coal transportation of at least 10 tons, imported by sea.

For exceptional temporary rates Nos. 6 and 31, see Table No. 2.

(*f*) Rates of fourth class apply to shipments of 10 tons at least. If the shipment is less than 10 tons, rates of the third class are charged for a minimum of 5 tons, unless the rate of the fourth class for 10 tons be more advantageous to the shipper.

There is no minimum train load.

Coal is generally carried in open cars and by slow freight.

(*g*) Special and exceptional rates mentioned under the letter (*e*) have been made to develop the iron and other industries, also agriculture.

## QUESTION II.—RATES FOR IRON ORE, STONE, LUMBER, FERTILIZER, AND GRAIN.

See Table No. 1, pages 11–13.

Tables Nos. 1, 3, and 4 are in force on all Belgian railroads.

(*a*) For termini of each shipment, see Table No. 1.

(*b*) For distances of each shipment, see first column, Table No. 1.

(*c*, *d*) See statements under these letters for Question I above.

(*e*) The first, second, third, and fourth classes of Tariff No. 3 (slow freight) for which rates are given in Table No. 1 are the regular rates.

Special rates Nos. 24, 25, and 36, mentioned in said table, are reduced rates, No. 25 being only applicable to shipments for Belgian Iron Works, etc.

(*f*) For shipments by full carloads, rates of the first, second, and third classes of tariff No. 3 cover shipments of a minimum of 5 tons. For less than 10 tons see explanation under letter (*f*) of Question I above. Shipments under the rates of the first, second, and third classes are made, according to law, in closed cars or in cars covered with tarpaulins. Those made under the rates of the fourth class and special rates (see pp. 61–104 of pamphlet No. 1 bis.) Nos. 24, 25, and 26 are generally made in open cars and not covered with tarpaulins. Articles specified in tariff No. 3 are always carried by slow freight in full carloads.

(*g*) Special rates Nos. 24 and 25 have been made on iron ore in order to help the iron industry; the special rates of tariff No. 36 have been made in order to favor agriculture.

## QUESTION III.—EXPORT RATES.

See Table No. 3.

(*a*) For termini, see Table No. 1.

(*b*) For distance, see Table No. 3.

(*c*, *d*) Same answers as those given for the corresponding letters under Question I above.

(*e*) See Table No. 3.

These special rates are given on pages 29 to 43 of pamphlet No. 1 bis.

(*f*) Same answers as those for the corresponding letter under Question II.

QUESTION IV.—RATES FOR HIGH-GRADE CLASSIFIED FREIGHT.

In Belgium goods shipped in less than full carloads may be also carried under the rates and conditions of tariff No. 1 (express) and tariff No. 2 (prompt freight delivery).

Goods under tariff No. 1 (express) are carried by passenger trains; those under tariff No. 2 (prompt freight delivery) by trains carrying light goods.

Express rates (tariff No. 1) for packages weighing up to 60 kilograms, for all distances, are as follows:

| Weight. | Francs. | Cents. |
|---|---|---|
| 5 kilograms or less (11 pounds) | 0.80 | 15.4 |
| 5 to 10 kilograms (11–22 pounds) | 1.00 | 19.3 |
| 10 to 20 kilograms (22–44 pounds) | 1.50 | 28.9 |
| 20 to 30 kilograms (44–66.1 pounds) | 2.00 | 38.6 |
| 30 to 40 kilograms (66.1–88.2 pounds) | 2.50 | 48.2 |
| 40 to 50 kilograms (88.2–110.2 pounds) | 3.00 | 57.9 |
| 50 to 60 kilograms (110.2–132.3 pounds) | 3.50 | 67.5 |

Loading and unloading are done by the railroad.

Rates for prompt freight delivery (tariff No. 2) on packages weighing 60 kilograms or less, for all distances, are as follows:

| Weight. | Francs. | Cents. |
|---|---|---|
| 5 kilograms or less (11 pounds) | 0.50 | 9.6 |
| 5 to 10 kilograms (11–22 pounds) | .60 | 11.6 |
| 10 to 20 kilograms (22–44 pounds) | .70 | 13.5 |
| 20 to 30 kilograms (44–66.1 pounds) | .80 | 15.4 |
| 30 to 40 kilograms (66.1–88.2 pounds) | .90 | 17.4 |
| 40 to 50 kilograms (88.2–110.2 pounds) | 1.00 | 19.3 |
| 50 to 60 kilograms (110.2–132.3 pounds) | 1.10 | 21.2 |

Loading and unloading are done by the railroad.

Some modifications of these rates exist in particular cases.

The above rates and conditions are respectively mentioned on pages 18 and 19 of pamphlet No. 1, and on pages 3 to 13 of pamphlet No. 1 bis.

QUESTION V.—RATES ON TYPICAL PRODUCTS OF REGULAR CLASSIFIED FREIGHT.

See Table No. 4, page 18.

An additional charge is made for loading and unloading of goods, not in full carloads, and they are charged the rates of the first class of tariff No. 3 for a minimum weight of 400 kilograms (880 pounds).

However, certain articles, such as butter, colonial products, wheat, hay seeds, sugar, etc. (see Table No. 4), are favored with the special tariff No. 30. These special rates are shown on pages 86 and 87 of pamphlet No. 1 bis, 200 kilograms (440 pounds) being the minimum weight accepted.

See letters (*a*) and (*g*) under Question I.

Shipments in less than full carloads and less than 5,000 kilograms (1,100 pounds) are generally made by slow freight; occasionally by quick freight and transhipping.

The exclusive use of cars for shipments of this kind come under the rates of full carloads.

## QUESTION VI.—BASIS OF FREIGHT RATES.

In Belgium freight rates are based on a sliding scale, the longer the distance the lower the rate. They are also graded according to different classes of commodities.

## TABLE No. 1.

[Charges per 1,000 kilos (2,204 pounds).]

| Distances. | Iron ore. | | | | | | Stone. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Special tariff No. 24, shipments of— | | | | Special tariff No. 23 (shipments of 50 tons). | | Rough, regular tariff, fourth class of tariff No. 3. | | Cut, not polished, regular tariff, third class of tariff No. 3. | | Polished, regular tariff, second class of tariff No. 3. | |
| | 10 tons. | | 50 tons. | | | | | | | | | |
| | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. |
| 50 kilometers (31 miles) | 1.75 | $0.34 | 1.25 | $0.24 | 1.25 | $0.24 | 3.00 | $0.58 | 4.00 | $0.77 | 5.00 | $0.96 |
| 75 kilometers (46.6 miles) | 2.75 | .53 | 2.25 | .43 | 1.75 | .34 | 4.00 | .77 | 5.50 | 1.06 | 7.00 | 1.35 |
| 100 kilometers (62.1 miles) | 3.25 | .63 | 2.75 | .53 | 2.25 | .43 | 4.50 | .87 | 6.25 | 1.21 | 8.00 | 1.54 |
| 125 kilometers (77.6 miles) | 3.50 | .67 | 3.00 | .58 | 2.50 | .48 | 4.75 | .92 | 6.75 | 1.30 | 9.00 | 1.73 |
| 150 kilometers (93.2 miles) | 3.75 | .72 | 3.25 | .63 | 2.75 | .53 | 5.00 | .96 | 7.00 | 1.35 | 9.50 | 1.83 |
| 175 kilometers (108.7 miles) | 4.00 | .77 | 3.50 | .67 | 3.00 | .58 | 5.25 | 1.01 | 7.25 | 1.40 | 10.00 | 1.93 |
| 200 kilometers (124.2 miles) | 4.25 | .82 | 3.75 | .72 | 3.25 | .63 | 5.50 | 1.06 | 7.50 | 1.45 | 10.50 | 2.03 |
| 275 kilometers (170.8 miles) | 5.00 | .96 | 4.50 | .87 | 4.00 | .77 | 6.25 | 1.21 | 8.25 | 1.59 | 12.00 | 2.31 |
| 300 kilometers (186.4 miles) | 5.25 | 1.01 | 4.75 | .92 | 4.25 | .82 | 6.50 | 1.25 | 8.50 | 1.64 | 12.50 | 2.41 |
| 350 kilometers (217.4 miles) | 5.75 | 1.11 | 5.25 | 1.01 | 4.75 | .92 | 7.00 | 1.35 | 9.00 | 1.73 | 13.50 | 2.60 |

TABLE No. 1—Continued.

| Distances. | Wood. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | For building, regular tariff, third class of tariff No. 3. | | For fuel, special tariff No. 36. | | For cabinet-makers, regular tariff, first class of tariff No. 3. | | Timber with bark for mines, regular tariff, fourth class of tariff No. 3. | | Posts for mines, 1.8 meters (5.9 feet) in length and 30 centimeters (11.8 inches) in circumference at small end. | |
| | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. |
| 50 kilometers (31 miles) | 4.00 | $0.77 | 2.00 | $0.39 | 6.10 | $1.18 | 3.00 | $0.58 | 2.00 | $0.39 |
| 75 kilometers (46.6 miles) | 5.50 | 1.06 | 2.50 | .48 | 8.60 | 1.66 | 4.00 | .77 | 2.50 | .48 |
| 100 kilometers (62.1 miles) | 6.25 | 1.21 | 3.00 | .58 | 10.60 | 2.04 | 4.50 | .87 | 3.00 | .58 |
| 125 kilometers (77.6 miles) | 6.75 | 1.30 | 3.25 | .63 | 12.60 | 2.43 | 4.75 | .92 | 3.25 | .63 |
| 150 kilometers (93.2 miles) | 7.00 | 1.35 | 3.50 | .67 | 14.60 | 2.82 | 5.00 | .96 | 3.50 | .67 |
| 175 kilometers (108.7 miles) | 7.25 | 1.40 | 3.75 | .72 | 16.10 | 3.11 | 5.25 | 1.01 | 3.75 | .72 |
| 200 kilometers (124.2 miles) | 7.50 | 1.45 | 4.00 | .77 | 17.60 | 3.40 | 5.50 | 1.06 | 4.00 | .77 |
| 275 kilometers (170.8 miles) | 8.25 | 1.59 | 4.75 | .92 | 20.60 | 3.97 | 6.25 | 1.21 | 4.75 | .92 |
| 300 kilometers (186.4 miles) | 8.50 | 1.64 | 5.00 | .96 | 21.60 | 4.47 | 6.50 | 1.25 | 5.00 | .96 |
| 350 kilometers (217.4 miles) | 9.00 | 1.73 | 5.50 | 1.06 | 23.60 | 4.55 | 7.00 | 1.35 | 5.50 | 1.06 |

TABLE No. 1—Continued.

| Distances. | Fertilizer. | | | | | | | | Grain. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Manure, special tariff No. 36. | | Chemical fertilizers. | | | | Fertilizers not specially mentioned, regular tariff, fourth class of tariff No. 3. | | Regular tariff, third class of tariff No. 3. | |
| | | | Nitrate of soda, special tariff No. 36. | | Sulphate of ammonia, regular tariff, fourth class of tariff No. 3. | | | | | |
| | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. |
| 50 kilometers (31 miles) | 2.00 | $0.39 | 2.00 | $0.39 | 3.00 | $0.58 | 3.00 | $0.58 | 4.00 | $0.77 |
| 75 kilometers (46.6 miles) | 2.50 | .48 | 2.50 | .48 | 4.00 | .77 | 4.00 | .77 | 5.50 | 1.06 |
| 100 kilometers (62.1 miles) | 3.00 | .58 | 3.00 | .58 | 4.50 | .87 | 4.50 | .87 | 6.25 | 1.21 |
| 125 kilometers (77.6 miles) | 3.25 | .63 | 3.25 | .63 | 4.75 | .92 | 4.75 | .92 | 6.75 | 1.30 |
| 150 kilometers (93.2 miles) | 3.50 | .67 | 3.50 | .67 | 5.00 | .96 | 5.00 | .96 | 7.00 | 1.35 |
| 175 kilometers (108.7 miles) | 3.75 | .72 | 3.75 | .72 | 5.25 | 1.01 | 5.25 | 1.01 | 7.25 | 1.40 |
| 200 kilometers (124.2 miles) | 4.00 | .77 | 4.00 | .77 | 5.50 | 1.06 | 5.50 | 1.06 | 7.50 | 1.45 |
| 275 kilometers (170.8 miles) | 4.75 | .92 | 4.75 | .92 | 6.25 | 1.21 | 6.25 | 1.21 | 8.25 | 1.59 |
| 300 kilometers (186.4 miles) | 5.00 | .96 | 5.00 | .96 | 6.50 | 1.25 | 6.50 | 1.25 | 8.50 | 1.64 |
| 350 kilometers (217.4 miles) | 5.50 | 1.06 | 5.50 | 1.06 | 7.00 | 1.35 | 7.00 | 1.35 | 9.00 | 1.73 |

N. B.—The above charges do not include accessory charges. (See pages 22 to 27 of pamphlet No. 1bis.)

TABLE No. 2.

| Points of departure. | Points of arrival. | Distance. | | Regular tariff. | | | | Exceptional temporary tariffs. | | | | Special tariff. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Kilometers. | Equivalent in miles. | Third class of tariff No. 3, shipments per 5 tons—charge per ton (2,204 pounds). | | Fourth class of tariff No. 3, shipment of 10 tons—charge per ton (2,204 pounds). | | No. 6, shipments per 10 tons—charge per ton (2,204 pounds). | | No. 31, shipments per 50 tons—charge per ton (2,204 pounds). | | No. 54, shipments per 10 tons—charge per ton (2,204 pounds). | |
| | | | | Francs. | U. S. equivalent. | Francs. | U. S. equivalent. | Francs. | U. S. equivalent. | Francs. | U. S. equivalent. | Francs. | U. S. equivalent. |
| Charleroi | Brussels | 64 | 39.7 | 4.84 | $0.93 | ..... | ..... | 3.46 | $0.67 | 3.06 | $0.59 | ..... | ..... |
| Dampremy | Antwerp | 107 | 66.4 | 6.39 | 1.23 | ..... | ..... | 3.57 | .69 | 4.07 | .78 | ..... | ..... |
| Liers | Turnhout | 118 | 73.3 | 6.61 | 1.27 | ..... | ..... | 3.68 | .71 | 4.18 | .80 | ..... | ..... |
| Warquignies | Diest | 136 | 84.5 | 6.86 | 1.32 | ..... | ..... | 4.62 | .89 | 4.36 | .84 | ..... | ..... |
| Flenu | Bruges | 126 | 78.2 | 6.76 | 1.30 | ..... | ..... | 3.76 | .72 | 4.26 | .82 | ..... | ..... |
| Anderlues | Libramont | 142 | 88.2 | 6.92 | 1.33 | 4.92 | $0.95 | ..... | ..... | 4.42 | .85 | ..... | ..... |
| Mons | Verviers | 165 | 102.5 | 7.15 | 1.38 | 5.15 | 1.00 | ..... | ..... | 4.65 | .90 | ..... | ..... |
| Elouges | Gouvy | 238 | 147.8 | 7.88 | 1.52 | 5.88 | 1.13 | ..... | ..... | 5.38 | 1.04 | ..... | ..... |
| Elouges | Athus | 246 | 152.8 | 7.96 | 1.53 | 5.96 | 1.14 | ..... | ..... | 5.46 | 1.05 | ..... | ..... |
| Micheroux | Adinkerke-la-Panne | 257 | 159.7 | 8.07 | 1.55 | ..... | ..... | 5.07 | .98 | 5.57 | 1.07 | ..... | ..... |
| Zee-Bruges (quay) | Athus | 324 | 201.3 | 8.74 | 1.69 | ..... | ..... | ..... | ..... | 6.24 | 1.20 | 6.24 | $1.20 |

N. B.—The above charges do not include accessory charges (see pp. 22 to 27 of pamphlet No. 1bis).

## TABLE NO. 3.

*Comparative table of charges of special tariffs for exportation and those of the regular tariffs.*

[Charges per ton (2,204 pounds).]

| Distances. | Coal. | | | | Coal, rough. | | | | Cement. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Special tariff No. 1 for exportation (shipments per 10 tons). | | Regular tariff, fourth class of tariff No. 3. | | Special tariff No. 2 for exportation (shipments per 50 tons). | | Regular tariff No. 2 for exportation (shipments per 50 tons). | | Special tariff No. 5 for exportation (shipments per 50 tons). | | Regular tariff, fourth class of tariff No. 3. | |
| | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. |
| 50 kilometers (31 miles) | 2.20 | $0.42 | 3.00 | $0.58 | 2.00 | $0.39 | 3.00 | $0.58 | 1.95 | $0.38 | 3.00 | $0.58 |
| 75 kilometers (46.6 miles) | 2.20 | .42 | 4.00 | .72 | 2.00 | .39 | 4.00 | .72 | 1.95 | .38 | 4.00 | .72 |
| 100 kilometers (62.1 miles) | 2.60 | .50 | 4.50 | .87 | 2.00 | .39 | 4.50 | .87 | 2.35 | .45 | 4.50 | .87 |
| 125 kilometers (77.6 miles) | 3.25 | .63 | 4.75 | .92 | 2.50 | .48 | 4.75 | .92 | 3.00 | .58 | 4.75 | .92 |
| 150 kilometers (93.2 miles) | 3.90 | .75 | 5.00 | .96 | 3.00 | .58 | 5.00 | .96 | 3.65 | .70 | 5.00 | .96 |
| 175 kilometers (108.7 miles) | 4.55 | .88 | 5.25 | 1.01 | 3.50 | .67 | 5.25 | 1.01 | 4.30 | .83 | 5.25 | 1.01 |
| 200 kilometers (124.2 miles) | 5.00 | .96 | 5.50 | 1.06 | 4.00 | .72 | 5.50 | 1.06 | 4.75 | .92 | 5.50 | 1.06 |
| 250 kilometers (155.3 miles) | 5.50 | 1.06 | 6.00 | 1.16 | 5.00 | .96 | 6.00 | 1.16 | 5.25 | 1.01 | 6.00 | 1.16 |
| 275 kilometers (170.8 miles) | 5.75 | 1.11 | 6.25 | 1.21 | 5.50 | 1.06 | 6.25 | 1.21 | 5.50 | 1.06 | 6.25 | 1.21 |
| 300 kilometers (186.4 miles) | 6.00 | 1.16 | 6.50 | 1.25 | 6.00 | 1.16 | 6.50 | 1.25 | 5.75 | 1.11 | 6.50 | 1.25 |
| 325 kilometers (201.9 miles) | 6.50 | 1.25 | 6.75 | 1.30 | 6.50 | 1.25 | 6.75 | 1.30 | 6.25 | 1.21 | 6.75 | 1.30 |
| 350 kilometers (217.4 miles) | 7.00 | 1.35 | 7.00 | 1.35 | 7.00 | 1.35 | 7.00 | 1.35 | 6.75 | 1.30 | 7.00 | 1.35 |

TABLE No. 3.—*Comparative table of charges of special tariffs for exportation and those of the regular tariffs*—Continued.

[Charges per ton (2,204 pounds).]

| Distances. | Furniture (chairs). | | | | Fresh hides. | | | |
|---|---|---|---|---|---|---|---|---|
| | Special tariff No. 7 for exportation (shipments per 50 tons). | | Regular tariff, first class of tariff No. 3. | | Special tariff No. 8 for exportation (shipments per 10 tons). | | Regular tariff, fourth class of tariff No. 3. | |
| | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. |
| 50 kilometers (31 miles) | 5.00 | $0.96 | 6.10 | $1.18 | 4.50 | $0.87 | 5.00 | $0.96 |
| 75 kilometers (46.6 miles) | 7.00 | 1.35 | 8.60 | 1.65 | 6.25 | 1.21 | 7.00 | 1.35 |
| 100 kilometers (62.1 miles) | 8.00 | 1.54 | 10.60 | 2.04 | 7.13 | 1.38 | 8.00 | 1.54 |
| 125 kilometers (77.6 miles) | 9.00 | 1.74 | 12.60 | 2.43 | 7.88 | 1.52 | 9.00 | 1.74 |
| 150 kilometers (93.2 miles) | 9.50 | 1.83 | 14.60 | 2.82 | 8.25 | 1.59 | 9.50 | 1.83 |
| 175 kilometers (108.7 miles) | 10.00 | 1.93 | 16.10 | 3.11 | 8.63 | 1.66 | 10.00 | 1.93 |
| 200 kilometers (124.2 miles) | 10.50 | 2.03 | 17.60 | 3.40 | 9.00 | 1.74 | 10.50 | 2.03 |
| 250 kilometers (155.3 miles) | 11.50 | 2.22 | 19.60 | 3.78 | 9.75 | 1.88 | 11.50 | 2.22 |
| 275 kilometers (170.8 miles) | 12.00 | 2.32 | 20.60 | 3.97 | 10.13 | 1.95 | 12.00 | 2.32 |
| 300 kilometers (186.4 miles) | 12.50 | 2.41 | 21.60 | 4.17 | 10.50 | 2.03 | 12.50 | 2.41 |
| 325 kilometers (201.9 miles) | 13.00 | 2.51 | 22.60 | 4.36 | 10.88 | 2.10 | 13.00 | 2.51 |
| 350 kilometers (217.4 miles) | 13.50 | 2.60 | 23.60 | 4.55 | 11.25 | 2.17 | 13.50 | 2.60 |

TABLE No. 3.—*Comparative table of charges of special tariffs for exportation and those of the regular tariffs*—Continued.

| Distances. | Manufactured steel. | | | | Iron bars (rough). | | | |
|---|---|---|---|---|---|---|---|---|
| | Special tariff No. 9 for exportation (shipments per 10 tons). | | Regular tariff, second class of tariff No. 3. | | Special tariff No. 13 for exportation (shipments per 10 tons per car as minimum). | | Regular tariff, third class of tariff No. 3. | |
| | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. | Francs. | United States equivalent. |
| 50 kilometers (31 miles) | 4.00 | $0.77 | 5.00 | $0.96 | 2.10 | $0.40 | 4.00 | $0.77 |
| 75 kilometers (46.6 miles) | 5.50 | 1.06 | 7.00 | 1.35 | 3.10 | .60 | 5.50 | 1.06 |
| 100 kilometers (62.1 miles) | 6.25 | 1.21 | 8.00 | 1.54 | 3.60 | .69 | 6.25 | 1.21 |
| 125 kilometers (77.6 miles) | 6.75 | 1.30 | 9.00 | 1.74 | 3.85 | .74 | 6.75 | 1.30 |
| 150 kilometers (93.2 miles) | 7.00 | 1.35 | 9.50 | 1.83 | 4.10 | .79 | 7.00 | 1.35 |
| 175 kilometers (108.7 miles) | 7.25 | 1.40 | 10.00 | 1.93 | 4.35 | .84 | 7.25 | 1.40 |
| 200 kilometers (124.2 miles) | 7.50 | 1.45 | 10.50 | 2.03 | 4.60 | .89 | 7.50 | 1.45 |
| 250 kilometers (155.3 miles) | 8.00 | 1.54 | 11.50 | 2.22 | 5.10 | .98 | 8.00 | 1.54 |
| 275 kilometers (170.8 miles) | 8.25 | 1.59 | 12.00 | 2.32 | 5.35 | 1.03 | 8.25 | 1.59 |
| 300 kilometers (186.4 miles) | 8.50 | 1.64 | 12.50 | 2.41 | 5.60 | 1.08 | 8.50 | 1.64 |
| 325 kilometers (201.9 miles) | 8.75 | 1.69 | 13.00 | 2.51 | 5.85 | 1.13 | 8.75 | 1.69 |
| 350 kilometers (217.4 miles) | 9.00 | 1.74 | 13.50 | 2.60 | 6.10 | 1.18 | 9.00 | 1.74 |

## TABLE No. 4.

[Charges per 1,000 kilos (2,204 pounds).]

| Distances. | Full carloads. | | | | | | | | Incomplete carloads. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Butter, colonial products (groceries), refined sugar, first class of tariff No. 3 (shipments per 100 kilos minimum). | | Steel (billets), manufactured iron, fresh hides, second class of tariff No. 3 (shipments of 5 tons minimum). | | Wood for building, cement, wheat, hayseed, etc., third class of tariff No. 3 (shipments of 5 tons minimum). | | Coal, lime, waste quarry stone, fertilizers not specially mentioned, rough cast iron, fourth class of tariff No. 3 (shipments of 10 tons minimum). | | Minimum shipment 400 kilos. (See exceptions in tariff No. 3.) | |
| | Francs. | U. S. equivalent. | Francs. | U. S. equivalent. | Francs. | U. S. equivalent. | Francs. | U. S. equivalent. | Francs. | U. S. equivalent. |
| 50 kilometers (31 miles) | 6.10 | $1.18 | 5.00 | $0.96 | 4.00 | $0.77 | 3.00 | $0.58 | 2.50 | $0.48 |
| 100 kilometers (62.1 miles) | 10.60 | 2.06 | 8.00 | 1.54 | 6.25 | 1.21 | 4.50 | .87 | 4.30 | .83 |
| 125 kilometers (77.6 miles) | 12.60 | 2.43 | 9.00 | 1.74 | 6.75 | 1.30 | 4.75 | .92 | 5.10 | .98 |
| 150 kilometers (93.2 miles) | 14.60 | 2.82 | 9.50 | 1.83 | 7.00 | 1.35 | 5.00 | .96 | 5.90 | 1.14 |
| 175 kilometers (108.1 miles) | 16.10 | 3.11 | 10.00 | 1.93 | 7.25 | 1.40 | 5.25 | 1.01 | 6.50 | 1.25 |
| 200 kilometers (124.2 miles) | 17.60 | 3.40 | 10.50 | 2.03 | 7.50 | 1.45 | 5.50 | 1.06 | 7.10 | 1.37 |
| 225 kilometers (139.8 miles) | 18.60 | 3.59 | 11.00 | 2.12 | 7.75 | 1.49 | 5.75 | 1.11 | 7.50 | 1.45 |
| 250 kilometers (155.3 miles) | 19.60 | 3.78 | 11.50 | 2.22 | 8.00 | 1.54 | 6.00 | 1.16 | 7.90 | 1.52 |
| 275 kilometers (170.8 miles) | 20.60 | 3.97 | 12.00 | 2.32 | 8.25 | 1.59 | 6.25 | 1.21 | 8.30 | 1.60 |
| 300 kilometers (186.4 miles) | 21.60 | 4.17 | 12.50 | 2.43 | 8.50 | 1.64 | 6.50 | 1.25 | 8.70 | 1.68 |
| 325 kilometers (201.4 miles) | 22.60 | 4.36 | 13.00 | 2.51 | 8.75 | 1.69 | 6.75 | 1.30 | 9.10 | 1.76 |
| 350 kilometers (217.4 miles) | 23.60 | 4.55 | 13.50 | 2.60 | 9.00 | 1.74 | 7.00 | 1.35 | 9.50 | 1.83 |

N. B.—The above charges do not include accessory charges. (See pages 22 to 27 of pamphlet No. 1 bis.)
For merchandise of all kinds, classed under the fourth class tariff No. 3, shipped in quantities of less than 5 tons, see column 1 of this table.
For polished stones and window glass, see second column of this table.

## CHAPTER II.

### Rivers and Canals in Belgium.

#### I. PUBLIC SUPERVISION.

(*a*) There are in Belgium nearly 100 canals and waterways, with a combined length of about 2,200 kilometers (1,367 miles), which are navigable for ships and boats and useful for floating rafts, etc.

Of these, 1,800 kilometers (1,118½ miles) are under Government control, and about 400 kilometers (248½ miles) are under the control of Provinces, communes, companies, etc.

The length of all canals and waterways, including those of which only a part is navigable, in the two Flanders is 519 kilometers (322 miles), as more fully appears by the report on Canals and Inland Waterways of the Consular District of Ghent, Belgium, sent herewith and made part of this report. (See Chap. IV.)

(*b*) (1) Navigation corporations are independent and established in accordance with the regular corporation laws of Belgium. Companies must also submit to the rules and regulations of the canals and the waterways with which their business is connected.

There are no rules relating to freight rates in Belgium.

The reports of operation must be made according to the regular corporation laws of Belgium. Much information is given in the reports of the Société Anonyme du Canal et des Installations Maritimes de Bruxelles for the years 1896, 1898, 1899, 1900, 1901, 1902, 1904, 1905, 1906, 1907, 1908; also in a pamphlet "Notice sur le Port de Bruxelles 1907" (Notice on the Port of Brussels), and in a booklet entitled "Paris 1900—Royaume de Belgique—Installations Maritimes," on the maritime installations of Belgium.

The Government, Provinces, communes, companies, etc., have charge of the expenses of maintenance and improvement of the waterways they respectively control.

(2) Statistics of water-borne traffic are collected at the locks and at some bridges by agents, and also by collectors of navigation tolls. The data collected by the agents and collectors are combined and published under the supervision of the administration of bridges and highways (administration des ponts et chaussées). These statistics appear every year in a publication of the department of the interior (ministère de l'intérieur), entitled "Annuaire Statistique de la Belgique."

#### II. WATERWAY IMPROVEMENTS.

(*a*) There is no policy as to water power developed by works constructed for improving navigation.

(*b*) Appropriations are made by the Government for work executed by local authorities. Such subsidies are not granted to private corporations or parties.

The capital spent by the Belgian Government for the improvement and maintenance of waterways during the period from 1875 to 1907 amounted to about 621,000,000 francs ($119,853,000). The improvements consist especially in:

(A) The normalization of river beds, the rectification of their course, the consolidation of their banks, the improvement of haulage paths and locks, construction of houses for the agents of the canal, lock, and bridge service.

(B) The deepening and widening of canals, construction and improvement of locks, consolidation of banks, construction of walls for commercial use, improvement of haulage paths, the building of houses for agents of the canal, lock, and bridge service.

(C) The improvement of the coast and seaports and their preservation.

Sums paid by the Government for the construction of the port of Brussels and the improvement of the canal from Brussels to the River Rupel amounted from the year 1901 to the year 1908, both inclusive, to 11,480,848.27 francs ($2,215,803.72).

Sums paid by the Société Anonyme du Canal et des Installations Maritimes de Bruxelles for the construction of the port of Brussels and the improvement of the canal from Brussels to the River Rupel amounted during the period from 1900 to 1908, both inclusive, to 17,700,000 francs ($3,416,100).

### III. FLOATING EQUIPMENT.

Boats circulating on Belgian canals and waterways may be divided in four classes:

1. Flat-bottomed boats, without sails, generally hauled or towed.
2. Flat-bottomed boats, with sails, and shaped in accordance.
3. Large Rhine boats with or without sails.
4. Steamers.

Boats of the first class generally circulate on canals and waterways of the north of France and in Belgium, descending but exceptionally on the part of the River Scheldt below Antwerp, Belgium. These flat-bottomed boats have a small mast and a small sail called staysail (foc), which is only rarely used.

This class of boats includes:

(*a*) The flatboats of the Charleroi Canal, called "baquet" in French and "bak" in Flemish, of a nearly parallelopiped form and measure generally about 19.50 meters (64 feet) in length, and from 2.60 to 2.65 meters (8.52 to 8.69 feet) in width. The draft varies from 0.35 to 0.40 meter (1.15 to 1.31 feet) when the boat is unloaded, and is about 1.80 meters (5.90 feet) when the boat is loaded. The tonnage varies from 67 to 72 tons. The baquet was especially created for use on the canal from Charleroi to Brussels. There were in 1901 over 1,500 of these boats in use. They are built of wood at a cost of 4,500 francs ($848.50) and of iron at a cost of 7,500 francs ($1,447.50) without sail and accessories. On account of the widening of the Charleroi Canal these boats are expected to disappear after some time.

(*b*) The walloon boats, or pinnaces, called "waal" in Flemish, also of a nearly parrallelopiped form have various names such as

"tournaisien" (from Tournai), lighter, bilander and pointed, according to the form given to the ends.

(1) The two former are more popular and measure 37.50 to 39 meters (123 to 127.92 feet) in length and 5 to 5.05 meters (16.40 to 16.56 feet) in width. Their draft when unloaded is of about 0.28 meter (0.92 foot) when built of wood and of about 0.35 meter (1.15 feet) when built of iron. When loaded their draft varies according to the waterway and the tonnage from 1.80 to 2.30 meters (5.90 to 7.54 feet). The load is from 300 to 370 tons, according to the length of the boat. Wood pinnaces cost from 13,000 to 14,000 francs ($2,509 to $2,702), without sail or cordage. Iron pinnaces cost from 16,000 to 17,000 francs ($3,088 to $3,281). There are some tournai boats of 40 meters (131.20 feet) in length which are built so as to make use of the maximum capacity of the locks on some waterways.

(2) The bilander and the pointed are old model boats and not as good for transportation as the tournaisien and the pinnace.

The sizes vary considerably; the bilander from 28 to 34 meters (91.14 to 111.52 feet) in length, and from 4.60 to 5 meters (15.08 to 16.40 feet) in width. The draft when empty is from 0.30 to 0.40 meter (0.98 to 1.31 feet) and when loaded about 2 meters (6.56 feet). The tonnage is about 280 tons for large boats and 160 for small boats.

The pointed (pointu) generally measures from 20 to 30 meters (65.60 to 98.40 feet) in length, which is only rarely exceeded. The width is from 3.50 to less than 5 meters (11.50 and 16.40 feet). When empty the draft is of about 0.35 meter (1.15 feet), and loaded about 1.80 meter (5.90 feet). The tonnage varies from 100 to 200 tons, according to the proportion of the boat. The largest "pointed" are of 32 meters (104.96 feet) in length, 4.90 meters (16.07 feet) in width. When loaded the draft is of 2.15 meters (7.05 feet), and the maximum load is 250 tons. These boats have a marked tendency to disappear.

(3) The Meuse boats diminish in width at the ends where they are pointed. They include the hernas and mignolles built of wood, and "pointed" built of iron.

The herna and mignolle are flat-bottomed boats with curved sides. Their transversal section is more or less of a trapezoid form with the large base on the top. When the boat is pointed, it is called "mignolle"; when the point is cut it is called "herna."

Wood herna are now built with a length of 38.80 meters (127.26 feet) and a width of 5 meters (16.40 feet). When empty, the draft is of 0.28 meter (0.92 foot); when loaded, of 1.90 meters (6.23 feet), and the tonnage reaches 280 tons.

Iron herna vary from 39 to 43 meters (127.92 to 141.04 feet), with a width of 5 meters (16.40 feet). Empty, their draft is of 0.35 meter (1.15 feet); loaded, it is from 1.80 to 1.90 meters (5.90 to 6.23 feet); the tonnage reaches from 280 to 300 tons, according to the length. Boats of this type, measuring from 38.50 to 39 meters (126.30 to 127.72 feet), built of iron, especially are in use on the canal from Liege to Antwerp; also from Liege, Belgium, to the Rhine (Germany and Holland).

The "pointed," better known under the Flemish name spits, is built of iron and is of recent origin. The pointed is of rather rectan-

gular form, and is also known under the name fox terrier. It is the best type for transportation.

The size of these boats is generally from 38.50 to 39 meters (126.30 to 127.72 feet) in length, 5 meters (16.40 feet) in width; the draft when empty is of about 0.35 meter (1.15 feet) and with a gauge of 1.80 to 1.90 meters (5.90 to 6.23 feet) when loaded. The load varies from 2.60 to 2.80 tons, and when the gauge is of 2.10 meters (6.89 feet) from 300 to 320 tons.

A boat of this capacity costs from 18,000 to 21,000 francs ($3,474 to $4,053). Sometimes for the exclusive traffic from the Meuse to Antwerp, Holland, and the Rhine these boats are built with a length of 43 meters (141.04 feet), a width from 5 to 6.50 meters (16.40 to 21.32 feet), a draft of 1.90 meters (6.23 feet), when from 330 to 350 tons may be transported.

(4) French boats are of two types, the westerling and the flute, which are used in the Flanders and the northwest of France. They are disappearing.

The westerling is a flat-bottomed boat of a more or less trapezoid form; it measures in length from 19 to 26 meters (62.32 to 85.28 feet), in width from 3.60 to 4.40 meters (11.81 to 14.42 feet); the draft when empty is 0.35 meter (1.15 feet), and the tonnage according to the draft varies from 60 to 160 tons.

The flute is a flat-bottomed boat of a rectangular form, sharply pointed at the end.

(*b*) The second class includes boats from the Brabant and Holland, built especially for navigation with sails. The bottom is flat, but somewhat curved on the sides; the ends are a little higher than the center. The shapes vary indefinitely when built of wood, but are more regular when built of metal.

(1) There are three well-known types of Brabant boats, known as the otter, the schuit, and the pleit.

(A) The otter type varies considerably. The length is generally from 20 to 28 meters (65.60 to 91.84 feet), and is never under 16 meters (52.48 feet) or over 30 meters (98.40 feet). The width is from 4 to 5 meters (13.10 to 16.40 feet); when empty the immersion is from 0.50 to 0.70 meter (1.64 to 2.30 feet); when loaded it varies from 1.70 to 2.20 meters (5.58 to 7.22 feet), but it is generally 1.80 meters (5.90 feet). The tonnage varies from 70 to 180 tons, but generally is from 100 to 150 tons.

(B) The schuit, or barge, is the same kind of boat as the otter, but smaller in size. The medium length is 14 meters (45.92 feet), and the length never exceeds 17 meters (55.80 feet); the width never exceeds 5 meters (16.40 feet); the draft when the boat is empty is 0.80 meter (2.62 feet); loaded, it varies from 1.50 to 1.80 meters (4.92 to 5.90 feet); the tonnage rarely exceeds 40 tons. The sails are with difficulty lifted and lowered; this is the reason why these boats are only seen in the maritime part of the River Scheldt, in Brussels, Antwerp, Tamise, and Boom. This type is rapidly diminishing, as boat builders of lower Belgium are no longer constructing them.

(C) The type of the pleit is about the same as the type of the bilander. These boats are now built regularly at a minimum length of 35 meters, a width of 5 meters (114.8 and 16.40 feet); when empty the draft is 0.40 meter (1.31 feet); when loaded the draft is of 2

meters (6.56 feet); the tonnage is 270 tons. A pleit costs about 22,000 francs ($4,246), and its sail is easily lifted and lowered.

(2) Dutch boats (Holland type) include the hengst, hoogaerts, tjalk, and aak built of wood, and the Rhine boats, built of iron, and are of the aak type.

(A) The hengst and hoogaerts are small Zeeland boats of 10 tons for fishing mussels.

(B) The tjalk has the shape of the otter, but the curve is more pronounced, and this boat is now also built of iron. Boats of this type longer than 25 meters (82 feet) and of tonnage greater than 150 tons are rarely seen. The regular length is from 16 to 24 meters (42.48 to 78.72 feet); the width is from 4.70 to 5.50 meters (15.72 to 18.04 feet). The tonnage is from 50 to 150 tons. There are in Brussels boats of this type from 12 to 15 meters (39.36 to 49.20 feet) long and 4.50 meters (14.76 feet) wide, with a capacity from 35 to 40 tons.

(C) The aak of wood has generally two masts. The length of this type of boat varies from 25 to 36 meters (82 to 118.08 feet); the width is rarely below 5.50 meters (18.04 feet) and generally 6 meters (19.68 feet). When the boat is empty the draft is from 0.50 to 0.70 meter (1.64 to 2.30 feet), and when loaded from 1.80 to 2 meters (5.90 to 6.56 feet). The tonnage is rarely less than 150 tons and sometimes reaches 275 tons. A few aak measure 43 meters (141.04 feet) in length, 7.35 meters (24.11 feet) in width, and have a tonnage of 350 tons. This type of boat is not built much now and is being replaced by the Rhine boats built of iron.

(3) Special type aak of small capacity and built of iron. During the last years the otter has given place to the aak boats built of iron, which are quite different from all the types of boats of the second class and even differ from the aak built of wood above described. The width remains constant, the sides are flat, the front is pointed, and the end is curved. The length of these boats varies from 18 to 33 meters (59 to 108.24 feet). The width is generally about 5 meters (16.40 feet), sometimes about 6 meters (19.68 feet). The draft is from 0.35 to 0.60 meter (1.15 to 2.13 feet) when empty, and from 1.60 to 2 meters (4.25 to 6.56 feet) when loaded. The tonnage is generally from 100 to 175 tons, sometimes also under 50 tons and sometimes over 225 tons. These boats are fitted with sails.

(*c*) The third class includes the iron Rhine boats of the aak, kast, and spits types.

(A) The Rhine aak had the type of the wood aak, but there are not many of them. It is now a boat of from 41 to 44 meters in length; the width is never less than 6.50 meters (21.32 feet), and reaches 7.50 meters (24.60 feet); when empty the draft is of 0.55 meter (1.80 feet); loaded from 2.10 to 2.35 meter (6.89 to 7.71 feet). The tonnage is not less than 350 tons and often over 400 tons.

The iron aak of 450 tons costs from 32,000 to 35,000 francs ($6,176 to $6,755) without sails or cordage. The sails are very important and another large cause for expense.

(B) The kast is of a less pointed type than the Rhine aak and is very popular. Those coming to Brussels measure from 42 to 44 meters (137.76 to 144.32 feet) in length and 6.50 to 7.30 meters (21.32 to 23.94 feet) in width. When empty the immersion is from 0.40 to

0.50 meter (1.31 to 1.64 feet); when loaded from 2 to 2.30 meters (6.56 to 7.54 feet). The tonnage is rarely below 400 tons and the maximum is 483 tons. Without accessories a kast costs from 35,000 to 40,000 francs ($6,755 to $7,720). Boats transporting petroleum for the American Petroleum Co. from Antwerp to Brussels are of the kast type.

Boats of the kast type with a tonnage of from 500 to 2,000 tons are in use below Antwerp, but could not possibly pass through locks on the canals, and can not therefore be used in larger proportions. When the port of Brussels is completed boats of 1,000 tons of this type will be able to reach this port.

(*d*) The fourth class includes cargo steamers and steam towboats. Cargo boats effect regular services between Brussels and other ports of Belgium and Holland. They belong to the kast type, and have a mast for lifting merchandise; the length varies from 35.20 to 37.50 meters (115.46 to 123 feet); the width is about 5 meters (16.40 feet), and the tonnage varies from 134 to 202 tons.

Steam towboats usually tow a load of not exceeding 900 tons, but the load could be of 1,080 tons. These boats are built with a view to their utilization as ice breakers.

## IV. OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

(*a*) Canal companies own and operate vessels. The Government does not, except in Antwerp and some maritime ports, this being quite exceptional.

The Société Anonyme du Canal et des Installations Maritimes de Bruxelles owns towing boats for which the running expenses in 1908 were 346,095 francs ($66,796.23) and the receipts 383,695 francs ($74,053.13), thus showing a profit of 37,599 francs ($7,256.90).

(*b*) There are cases of consolidation of vessel owners into corporations operating small fleets on inland waterways.

(*c*) Vessels are not owned or operated by railroads, but some are owned and operated by distributing concerns in Tournai (Hainaut) for the transportation of rough stones from that city to Holland.

(*d*) Public authorities do not own or operate merchant vessels.

(*e*) The Société Anonyme du Canal et des Installations Maritimes de Bruxelles controls the towing service on the canal from Brussels to the River Rupel, the profits of which are given above in answer (*a*) of this question.

## V. TERMINAL FACILITIES.

(*a*) The Government builds walls and wharfs alongside the waterways as well as wooden wharves.

(*b*) The most advanced methods of loading and unloading are cranes and elevators with scoops.

(*c*) Railroad tracks are located everywhere on terminals of inland waterways and in every important place. These lines form a belt railroad connecting all the railroads at given ports; such is the case in Brussels, Antwerp, Ghent, and other ports.

(*d*) River and canal terminals are owned by public and private interests. They are owned by Government, but not by private railroads.

(*e*) Each commune has its own dockage fees and other terminal charges, which have to be approved by the Government. The tariff in use in the commune of St. Nicolas, in the Flemish language, gives the following examples of tolls on different waterways: Maritime Scheldt below Ghent, no charges; canalized Meuse, 0.0016 franc (0.0003 cent) per ton-kilometer; canal of junction of the Meuse and Scheldt, 0.005 franc (0.001 cent) per ton-kilometer; conceded canal from Blaton to Ath, 0.024 franc (0.0046 cent) per ton of load, 0.008 franc (0.0015 cent) per ton of capacity or for empty boats returning.

### THE PORT OF ANTWERP.[1]

(*a* and *b*) To describe the terminal facilities for the Canal de la Campine, which connects Antwerp with the Belgian canal system, is to describe the port of Antwerp, which, at the present time, by reason of the magnitude and solidity of its river wall and quays, the depth of the river, the splendid system of hydraulic hauling and lifting power, its geographical situation and its neutrality, is, perhaps, the most favored port of all Europe, and ranks certainly among the finest in the world. For a distance of more than 4½ miles along the river wall extends a line of massive stone quays, up to which ocean steamers of 17,000 tons may steam with perfect safety. This entire extent of quays, as well as those which border the inner docks and basins, is covered with iron sheds, roofed with zinc and glass, where merchandise lies sheltered and protected. Though the Antwerp dock and quay system is very large, it is still ordinarily insufficient for the ever-increasing tonnage, in spite of the fact that a few years ago the river wall was extended up the river for a distance of 6,500 feet, and that in 1907 two new docks, known as the intercalary docks, were added to the inner dock system.

*Description of the port.*—The approach to Antwerp by water from the sea gives at a glance a fair view of the extent of the port. In passing Austruweel one sees on the left the new sluice leading into the Lefebvre and American docks, the intercalary docks, and the warehouse of the Antwerp Grain Works Co. In front lie the inner docks and basins, while as far as the eye can see, along the city side of the river runs the magnificent stretch of quay walls and sheds. Beyond these, in the confused distance, one can just catch a glimpse of the vast oil installations of the American, Russian, and German oil companies. The inner dock system consists of 10 basins, furnishing a length of quay of 13,760 meters (15,011 yards). Thus the total length of dock and river quays amounts to 23,779 yards.

*River quays.*—The river quays comprise a strip of land running their entire length, of a minimum width of 100 meters (109 yards), along which there are distributed 143 rolling hydraulic cranes, the majority having a lifting power of 1½ tons, others of 2 tons, and one of 30 tons. As before stated, at the south end of the river quays there are the oil installations, which cover an area of 30 hectares (74.131 acres). Along the entire length of the river quays run the rails of the State Railway. The depth of water at low tide at the foot of the quays is 8 meters (26.2 feet), and at high tide 12.29 meters (40.3 feet), the top of the quay wall being 2.60 meters (8.5 feet) above the average high tide.

[1] Supplied by the American consul general at Antwerp.

*Docks.*—Besides the petroleum installations at the south there are three small docks used by barges and river craft and occasionally by small steamers. At the northern end of the town the great docks, properly called, are situated. The smallest of these were constructed in 1806, and are known as the Bonaparte and Guillaume Docks. The others were constructed at various periods during the nineteenth and twentieth centuries.

The entire dock system and the quays are supplied with hydraulic force from two powerful central stations at the northern and southern extremities of the city, respectively, giving a pressure of 50 atmospheres, which supply the motive power for the 143 cranes already referred to, and for 188 additional cranes for the inner docks, besides two large cranes of 40 tons each, two of 20 and one of 10 tons. There is also a coal tip capable of lifting trucks of 25 tons and loading 10 trucks per hour.

Communicating with the river and dock quays is an excellent railway service. All along the different lines of quays the railroad cars run so close to the steamers that in most cases the cranes can, with a single swing, lift the cargo from the hold and lower it into the railway cars or lighters, and vice versa.

(*c*) The city of Antwerp is surrounded by belt lines, connecting the entire dock system and the river quays, all belonging, of course, to the State Railway system. A railroad truck arriving, say, for instance, at the principal freight station at the north extremity of the town, could be transferred over the circle around the city to the South Station at the southwestern extremity of the city, and then carried along the river front around to its original starting point, passing every river quay and encircling every dock. The Canal de la Campine empties directly into the Asia Dock, from whence barges can find their way through the dock system into the river, and in all the docks they have access to the hydraulic lifting and hauling power. The canal boats are thus enabled to discharge their cargoes either directly into railroad trucks or to transship them directly into steamers lying in the docks or at the river quays. For instance, a shipment of coal from Liege can come up the River Meuse through the Scheldt and Meuse Junction, through the Canal de la Campine, through the Antwerp dock system into the Scheldt, and there be discharged into ocean-going vessels.

(*d*) River and canal terminals are owned by the public authorities.

(*e*) Inland vessels, as well as tugs, which enter the docks at the northern extremity of the city of Antwerp, pay per ton:

| | | Franc. |
|---|---|---|
| Under 50 tons, regardless of the number of voyages made in a year | | 0.08 |
| Vessels of 50 tons and more: | | |
| First voyage | per ton | .25 |
| Second voyage | do | .22 |
| Third voyage | do | .17 |
| Fourth voyage | do | .12 |
| Fifth voyage and for each subsequent voyage | do | .05 |

On payment of this tax, inland vessels may sojourn for two months in the docks. After this time they are required to pay 0.05 franc (1 cent) per ton and per month. Each month commenced must be paid in full.

## VI. TOLLS AND FREIGHT RATES.

(*a*) There are usually tolls and other charges for the use of waterways.

Navigation charges (droits de navigation) are fixed per ton of 1,000 kilograms (2,204 pounds) on a distance of 1 kilometer (0.62136 mile). This measure is called "tonne kilométrique."

The minimum charge is 20 centimes ($0.04).

The fractions of less than half a ton are free in the calculating of the charges; those exceeding this are counted as a full ton-kilometer.

Owners of boats sailing empty have to take a permit of passage from the receivers of navigation charges at a cost of 20 centimes ($0.04).

Boats are considered empty with less than one-half ton of merchandise on board; also boats that do not draw more than 1 inch of the gauge measure.

Charges are payable in advance at one station or from station to station.

Rafts transporting wood and timber are calculated at the rate of 1 cubic meter per ton.

The following are not subject to navigation charges and are not required to take out permits of circulation:

(1) Boats belonging to the Army or serving for Army transportation. Also all boats belonging to the Government.

(2) Lighters (loaded or unloaded); ships having had to discharge part of their load on account of the reduction of the regular draft of water or for any other accidental cause, such as damage, etc.

(3) Boats for the waterway service and sailing on orders of agents of the administration.

(4) Towboats and ice breakers.

(5) Boats which have had to be removed on account of high or low waters.

(6) Boats transporting exclusively fertilizers and returning empty after having transported exclusively fertilizers if the return takes place within 10 days of the passage of the boat at the last station where it was recorded. Boats transporting fertilizers for export are not exempt from charges.

(7) Boats used for improvement or repair of waterways.

Boats engaged in the transportation of both passengers and merchandise pay reduced navigation charges which amount to three-eighths of the usual charges.

Boats engaged in regular service of transportation of merchandise pay one-third only of the usual charges. To guarantee payment, a monthly deposit is made in advance.

(*b*) Elements considered in the making of towing rates on canals and rivers are the condition of the rivers and canals and the importance of the current.

(*c*) Schedules of freight rates of inland water lines vary according to the condition of the rivers and canals and the importance of the currents. There are no regular classifications of freight.

(*d*) Rates are irregular according to traffic exigencies.

(*e*) No prorating arrangements exist between water lines and railroads.

(*f*) The department of bridges and highways (administration des ponts et chaussées) states that the distances are too short and the transportation on inland waterways and railways can not be compared with similar distances.

(*g*) There is competition between rail and water lines and there is no agreement for the division of traffic.

(*h*) There is no legislation regulating the relations between rail and inland water systems of transportation.

## VII. WATER-BORNE TRAFFIC.

(*a*) Statistics divide the commodities carried upon rivers and canals in eight classes as follows:

| Year 1907. | Tons-kilometer (2,204 pounds). |
|---|---|
| 1. Coal, coke, etc | 323,909,784 |
| 2. Ores, pig iron, stone, etc | 124,221,725 |
| 3. Building material (manufactured and raw) | 226,329,946 |
| 4. Pottery and glassware material | 96,104,562 |
| 5. Wood | 31,956,274 |
| 6. Agricultural products (natural and industrial) | 204,114,089 |
| 7. Sundry merchandise, cinders, fertilizers, and other undescribed merchandise | 147,592,594 |
| 8. Industrial products (all kinds) | 44,067,296 |

During the period from 1875 to 1907 the waterway traffic increased from 450,000,000 to 1,198,000,000 tons-kilometer, an increase of 166 per cent.

During the same period the increase for railway traffic was from 14,000,000 to 53,000,000 tons-kilometer, or nearly 400 per cent.

### WATER-BORNE TRAFFIC AT ANTWERP.[1]

(*a*) The principal commodities brought to Antwerp by inland waterways are: Coal, iron, steel, flour, cement, plate glass, minerals, grain, flax, phosphates, sand, stone, lumber, and sugar. An enormous traffic goes on at this port in grain carried from trans-Atlantic steamers by lighters, hence to the Rhine.

Grain, coal, metals, and ores in bulk are the principal cargoes carried into the interior from Antwerp, while the principal cargoes brought to Antwerp are coal, building stone, white sand, and sugar.

Bulk freight largely predominates.

(*b*) The water-borne traffic is increasing rapidly, as will be shown by the following table of canal tonnage entering the port of Antwerp since the year 1870:

| Years. | Tons. | Years. | Tons. |
|---|---|---|---|
| 1870 | 1,030,785 | 1900 | 4,994,247 |
| 1880 | 1,688,288 | 1904 | 7,008,223 |
| 1890 | 2,774,586 | 1908 | 7,505,244 |

For further details see statistics of the department of railroads at Brussels.

[1] Supplied by the American consul general at Antwerp.

(*c*) Local traffic predominates as compared with foreign traffic.

For full information on this subject I have been referred to the Association Internationale Permanente des Congrès de Navigation at the ministère des chemins de fer at Brussels, where copies of publications containing data on this subject may be obtained.

The following are important publications: (1) A pamphlet entitled "Note de renseignements sur les voies navigables de la Belgique" (Information concerning Belgian waterways); (2) "Mouvement de la navigation interieure de la Belgique, 1905–6 (Movement of interior navigation of Belgium), giving details concerning navigation charges, movement of transportation, etc.; (3) Bulletin trimestreil publié par le bureau de la statistique générale du ministère de l'interieur et de l'agriculture (Trimestrial Bulletin of the bureau of general statistics), No. 1, first year, 1909, containing on page 5 information concerning railway accounts for the last four years, and the year 1900 for lines owned by the Government and companies. (4) The annuaire statistique de la Belgique (Bluebook) for the years 1899–1909 contains statistics for the last 10 years of vessel movement and traffic carried on inland waterways, also railroad traffic, tonnage, and ton-kilometers.

# CHAPTER III.

## Inland Waterways, Consular District of Liege, Belgium.

[By H. Abert Johnson, consul at Liege, Belgium.]

### I. SUPERVISION.

All navigable streams and canals are the property of the Government, their direct supervision resting mainly with two departments designated, respectively, the "bureau des ponts et chaussées," and the "service spéciale de la Meuse."

1. Such officials have nothing to do with the capitalization of navigation corporations; such corporations, as a matter of fact, do not exist in this consular district. Freight rates are arranged independent of any Government control or supervision.

These officials are charged with the maintenance and improvement of channels, docks, and terminal facilities, exclusive of all machinery or appliances for loading or unloading river craft, such machinery being in all cases the property of private individuals or firms.

2. Statistics of water-borne traffic are collected by the departments referred to and published by the Government.

### II. WATERWAY IMPROVEMENTS.

(*a*) In this consular district there is no established policy as to water power developed by works constructed for improving navigation, no use having been made up to the present of such water power.

(*b*) The first attempt at any systematic river improvement in this district was in the year 1841, under the supervision of Engineer Guillery. At this time the Meuse River consisted mainly of a series of basins connected by shoal water sections, having a channel of rapid current that seriously impeded the passage of boats going upstream and rendered navigation somewhat dangerous in the case of boats traveling in the opposite direction. At the period referred to (1841) little had been done toward the development of inland navigation, considered as an economic problem, and it was only after constant and untiring study of the question that Engineer Guillery decided to adopt a plan for facilitating navigation on the Meuse by the establishment of channels maintained at a depth of 1.50 meters through the erection of longitudinal jetties. Numbers of such jetties were constructed along the river course, some of them fulfilling satisfactorily the constructor's expectations, while others failed to produce satisfactory results and were subject later on to more or less serious modifications. In the meantime the work of improving the towpath along the banks was carried on at a uniform level of 3.50 meters above low-water mark. The system of canalization put into operation met with serious opposition. It was claimed that the insufficient depth

of water of the Meuse placed the navigation in a position of inferiority as compared with the situation created on the navigable waterways emptying into the river, and that economic communication with these arteries had been sacrificed with a view to the execution of a work of relatively small cost, it is true, but which could not fail to restrict traffic and was not in keeping with the development of the industries established in the Meuse valley, due to the more extensive application of steam.

In view of the objections raised and in accord with the suggestions of Engineer Cummer, the project favored was that of building a canal alongside of the Meuse from Liege to Maestricht, connecting with that already existing from Maestricht to Boise-le-Duc, in Holland, making a junction with the canal to Antwerp, with a depth of water of 2.10 meters (6 feet 9 inches), thus opening up a normally navigable waterway between Liege and Antwerp on the one hand, and between Liege and Holland on the other.

The acceptance of this project entailed the abandonment of the system of river channels constructed under the system previously in operation.

The year 1850 was made memorable by a flood in the Meuse valley which was most disastrous to property along the river banks. The water rose to a height of 5 meters (16 feet 3 inches) above normal level at Dinant, while at Huy and Liege the rise was 5.35 meters (17 feet 4 inches) and 5.20 meters (16 feet 10 inches), respectively.

In order to counteract the effect of certain modifications in the river banks at Liege, it was decided to change in a measure the course of the Ourthe River, causing it to empty into the Meuse at a point further down the river. This work was commenced in 1852 and terminated in 1864, while at the same time three additional dams with navigable locks were constructed; that of the "Fonderie des Canons, d'Avroy, and Jemeppe. The industrial establishments located above the basin of Liege were separated from the Maestricht-Liege Canal by a water course of 4 kilometers in length, the distance from Jemeppe to the "Fonderies des Canons," in which the depth of water was 1.90 meters (6 feet 2 inches), a depth sufficient to permit free navigation on the Liege Canal toward Antwerp and Holland and maintained by means of movable dams and lateral locks.

The work of canalization of the Meuse was carried on from 1862 to 1867 between Liege and Namur, thus placing Liege in direct communication with Charleroi, and in 1880 the work was completed up to the French frontier. The Belgian system of navigable waterways was thus placed in communication with that of the eastern part of France, notably with the canal of the Marne connecting with the Rhine and the Ardennes.

Two dams were constructed in 1863 and 1864, at Hermalle-sous-Argenteau on the one hand and at Vise on the other, in order to permit communication at the latter place by a short canal connecting with the Liege-Maestricht Canal. The dams built are of three different kinds. The first at Vise and Namur are of the Poirée type and comprise in addition to an overflow dam or weir of solid masonry placed longitudinally, varying in length from 150 to 200 meters (492 to 656 feet), and of transverse sluices with movable guides known as "fermettes aiguilles."

What is known as the Chanoine system was constructed at La Plante, Tailfer, and Rivière. Certain modifications in this class of dam were subsequently introduced. It was maintained, however, that these systems were far from satisfactory, on account of delay and complications in the mechanism required, and in many cases their operation constituted a menace to the safety of those operating the mechanism.

A commission appointed to select a convenient system of dams for those sections of the river still to be improved agreed finally to adopt what was termed a composite or mixed system—that is, a longitudinal dam in masonry with a sluice or overflow and a movable transverse dam with "fermettes aiguilles," as it is termed.

Up to the year 1880 as many as 23 lock dams were constructed on the Meuse from that of Hastière, above Dinant, to Visé. In December, 1880, another disastrous flood occurred in the Meuse Valley. The water began to rise on the 14th of the month, necessitating the opening of the movable dams, but it was not until four days later that the rise increased to an alarming extent. At this period, owing to excessive and continuous rainfall, the water rose to a height of 6 meters (19 feet) above normal level.

Owing to extensive works in the vicinity of this commune, especially that of the "dérivation," Liége fortunately did not suffer as severely from the flood as many other localities located along the river's banks. This flood covered a zone varying in width from 150 to 1,200 meters (492 to 3,936 feet): it interrupted communication and entailed the temporary cessation of many important industries and seriously threatened the public health of the entire valley.

In view of the immense amount of damage caused by floods of this character, the public became deeply interested in encouraging the Government to undertake with as little delay as possible important works that might tend toward preventing a recurrence of disasters of this nature.

It was at this epoch that the department of public works, in response to the desire for action on the part of those most interested, created the bureau of the service spécial de la Meuse, charged with the execution of works of river improvement, such as tended to diminish the danger from floods, and to facilitate river and canal navigation.

The total area of the Meuse Basin in Belgium is approximately about 1,300,000 hectares (1 hectare = 2.47 acres). After continuous rainfall or the rapid melting of snow, an enormous increase in the volume of water in the main valley of the Meuse takes place with marked rapidity. A mild rainfall, melting a snowfall of 40 to 50 centimeters (1 centimeter = 0.39 inch) that has fallen on frozen ground, would increase the volume of water in the Meuse more than five billions of cubic meters (1 cubic meter = 264 gallons), without counting the immense additional volume of water that would be brought down by that section of the Meuse situated in France.

Besides the floods referred to that, fortunately, do not occur much oftener than two or three times during a century, there are the ordinary annual rises, less violent in character, but nevertheless producing more or less damage to the crops on the low, level plains, and seriously interfering with the river-borne traffic.

Special attention has been directed by the bureau of service spécial de la Meuse to the matter of modifying the conformation of the river bed, with a view to minimizing the damage resulting from floods on the one hand and of removing obstacles to free navigation on the other hand.

It was claimed that, in the majority of river works, in allowing for the water flow the conformation of the river bed had not been given sufficient consideration; consequently, in the first six dams existing between the French frontier and Huy, the superficial area (water) was from 235 to 313 square meters (1 square meter = 10 square feet), for a rise in river at Hastière of 3.65 meters (11 feet) above normal level, while in the case of the three succeeding dams, those of Rivière, Tailfer, and La Plante, the superficial area of discharge ranged from 240 to 250 square meters. Serious defects were also found to exist in the construction of bridges where no provision has been made for an increased flow of water, and in most cases the supports of the bridges on either shore encroaching too extensively tended to impede the free flow when the river was swollen.

In 1830 but four bridges existed on the Meuse between Holland and the French frontier. Since that period as many as 14 works of this class have been constructed between Heer-Agimont and Visé, constructed for the most part in such a manner as to impede the free flow of water in periods of freshet. The industrial establishments along the river bank, deposits of all kinds, the throwing of rubbish into the river (although contrary to law), have all, together with the erosion of the banks, due to the rise in water level, tended to aggravate the situation and change the conformation of the river channel as well as of the entire valley of the Meuse. The banks of the Meuse in this district, and in fact for the greater portion of its course in Belgium, are regulated by building a wall of masonry at an angle of 45° and having an average thickness of 50 centimeters (1 centimeter = 0.3937 inch).

The improvements effected on the river result in producing a navigable channel of 40 meters (131 feet) in width with a depth below load water line of 2.50 meters (7 feet 6 inches).

The special configuration of the Meuse at Bouvignies, Beer, Seraing, and other places has been utilized in constructing docks or basins for the convenience of barges and other river craft. The immense ice floes occurring in the winter of 1890–91 clearly demonstrated the necessity for constructing such basins.

The basins of safety, as they are termed, at Beer and at Seraing are 300 and 350 meters long (984 and 1,148 feet), respectively, with widths of 50 meters (164 feet) for the former and from 20 to 52 meters (65 to 172 feet) for the latter. Their depth is 3.50 meters (10 feet 6 inches).

The basin at Bouvignies measures 180 by 32 meters (590 by 104 feet), with a depth of 10 feet 6 inches. Other basins are established at Seilles, Godinne, and in the vicinity of Huy.

The works referred to and all others, such as the construction and maintenance of locks, dams, dredging, filling, etc., are carried on by the General Government.

### III. FLOATING EQUIPMENT.

(*a*) Self-propelled cargo vessels are not generally used on the Meuse and few are owned in this consular district, the few that are in evidence coming mainly from Holland or Germany.

(*b*) The motive power in the case of self-propelled barges and canal boats is steam.

(*c*) The catalogue of Jabon Frères, of Ombret, contains some information on the types of boats.

(*d*) At the present time all canal boats and barges in this consular district are built of iron and steel.

(*e*) Cost of different types is given in the catalogue mentioned.

(*f*) There are no special types of boats for particular cargoes.

(*g*) Fleets of barges do not exist in this consular district.

(*h*) The boats of this locality are constructed with a view to utilization in both high and low water.

### IV. OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

(*a*) Canal companies or other waterway improvement companies do not exist in this consular district, all navigable waterways, as previously stated, belonging to the General Government.

(*b*) There are in this district no cases of consolidation of vessel owners into corporations operating fleets on inland waterways.

(*c*) No vessels in this district are owned by railways, nor do producing and distributing concerns, such as coal, oil, lumber, ore, etc., own fleets, generally speaking.

It may be noted that the Cockerill Steel Works own a fleet of 15 canal boats formerly used for transporting iron ore from Rotterdam; ore that had been shipped by sea from Spain. There are also two companies, one owning 3 and the other 9 steam barges. The former operates a regular freight service between Antwerp and Liege and the latter a freight service between Rotterdam and Liege.

(*d*) There are no fleets of merchant vessels owned and operated by public authorities.

(*e*) There are no instances of combinations or monopolies controlling towing on canals and rivers.

### V. TERMINAL FACILITIES.

(*a*) Floating wharf boats are not used in this locality, all freight being loaded and discharged on masonry docks, having no specially important or striking features.

(*b*) The methods of loading and unloading vessels on inland waterways have no features of special importance. Coal is loaded from the mines by means of small push cars that carry the coal from the mines and dump it directly into the boats, and this method of loading is practiced in the case of cement, lime, stone, etc.

The Cockerill company at Seraing have elevators for discharging ore and coal.

Certain flour mills along the Meuse employ small elevators for discharging grain, but with no features of special interest.

(*d*) River and canal terminals are Government property.

(*e*) There are no published lists of dockage fees issued.

## VI. TOLLS AND FREIGHT RATES.

Canal boats are required to pay a Government tax called "droit de navigation," based on the distance traversed and the amount of cargo carried. This tax on the Meuse River, extending from the French frontier to the canal Liege-Maestricht, is assessed at the rate of 0.00016 franc ($0.00003) per ton-kilometer (five-eighths mile).

On the Liege-Maestricht Canal the tax is levied at the rate of 0.0050 franc ($0.0009) per ton-kilometer, the same rate being charged on the canal from Bocholt to Antwerp.

(*b*) Towing rates are based on the distance traversed; that is, so much per kilometer. The rates vary according to the condition of the water, and range from about 0.80 centime ($0.15) to 1.50 francs ($0.29) per kilometer. No tariffs of towing rates are published.

(*c*) Inland water lines from this district as a terminal do not have regular schedules of freight, such rates being more or less arbitrary. The owner of a regular water line freight service, with one departure daily from Liege to Antwerp, has given me the following as an average tariff of freight charges: 6.10 francs ($1.17) per 1,000 kilograms (2,204 pounds) for shipments of not less than 5,000 kilos; 7.10 francs ($1.37) per 1,000 kilos for shipments of less than 5,000 kilos. These rates are charged on grains, coffee, oil, salt fish, etc. Freight rates by canal boat from Liege to Givet on the French frontier are, on an average, 2.50 francs ($0.48) per ton to Givet and 1.50 francs ($0.29) per ton from Givet to Liege.

(*d*) Inland waterway rates, so far as I can discover, are not affected by distance of haul.

Quantity of commodity offered does have an effect on the rate as shown by rates I have already given for shipments from Liege to Antwerp, there being an increase in the rate per 1,000 kilos of 1 franc ($0.193) for shipments of less than 5,000 kilos, as compared with shipments in quantities exceeding that amount. Speed does not seem to be considered in establishing water freight rates.

The character of the commodity affects inland waterway rates to a limited degree only.

(*e*) In this district there seem to be no prorating arrangements existing between water lines and railroads.

(*f*) I am informed that the Government railroads often modify their schedule rates in order to compete with inland water transportation.

These modifications of the scheduled rates, or rebates, are based on private agreements between shippers and the railroad administration, and are not, therefore, generally known to the public, so that it is not possible to cite any specific illustrations. Freight carriage by water is, as a general rule, not utilized for short distances, so that there seem to be no data available for determining whether waterways have greater competitive power in the case of short distances than in the case of long routes.

(*g*) I am informed by those interested in water traffic that railway competition, notwithstanding the fact that the railway lines in most cases are owned and operated by the Government, is decidedly keen and constitutes a serious obstacle to the successful development of inland navigation. There are, so far as I have been informed, no agreements existing between railroads and water lines for the division of traffic.

## VII. WATER-BORNE TRAFFIC.

(*a*) The principal commodities moved on the inland waterways of this district are coal, building material, ores, products of the glass and ceramic industries, metals and manufactures of metals, cement, lime, lumber, mineral oils, etc.

Package freight is of relatively small importance in comparison with the amount of bulk freight handled.

(*c*) On the inland water routes of this district local traffic does not figure to any appreciable extent.

## CHAPTER IV.

### Canals and Inland Waterways of the Consular District of Ghent, Belgium.

[By W. P. Atwell, consul at Ghent, Belgium.]

The consular district of Ghent, comprising the Provinces of East and West Flanders, shows a total population of approximately 1,969,000 inhabitants. The total area of these Provinces is 623,400 hectares (24,069 square miles), thus showing a density of 316 inhabitants per square kilometer (0.3861 square mile).

The total length of all canals and waterways, including those of which only a part is navigable, is 519 kilometers (322 miles).

The most important canals and waterways are under the surveyance and exclusive control of the Central Government located at Brussels. On these canals and waterways the Government collects all tolls and assumes and supports all expenses toward the improvement, construction, and general maintenance thereof. The provincial government assumes the responsibility of nonnavigable waterways, while on the other hand some of the more important cities located in the district also have the control and management of canals and waterways which have been built by them. In these last-mentioned cases the cities support all disbursements for improvements and maintenance and collect all tolls for navigation. It should also be remarked that barges and boats of all kinds, navigating through Government canals and waterways passing through large cities, where they discharge and take on wares and merchandise, and make use of the dock facilities built by the city, are taxed with a fee which is paid to the city for the use of wharfage facilities. This fee, when comparing one city with another, varies very little, the average being about 2 centimes per ton ($0.00386).

The total amount disbursed for improvements on the Rivers Scheldt and Lys, partially passing through this district and considered as the most important navigable rivers, amounted in 1908 to the total sum of 2,171,000 francs ($419,003), while the total amount disbursed for maintenance on these two rivers during the same period was 104,000 francs ($20,072). The total amount appropriated toward improvements now in course of construction on that section of these two rivers running through this consular district is 1,100,000 francs ($212,300).

#### Tolls and miscellaneous charges on canals and navigable waterways.

The principal navigable rivers of this consular district are the Scheldt and Lys, while the principal canals are the Ghent-Terneuzen Canal, a maritime canal connecting the port of Ghent with the North Sea, and the Ghent-Bruges Canal. All tolls and charges on

these rivers and canals are calculated per ton-kilometer, as follows: River Lys, 0.0016 franc ($0.0003) per ton-kilometer (0.621 mile); River Scheldt, no charges; Terneuzen Canal, 0.005 franc ($0.0009) per ton-kilometer (0.621 mile); Bruges Canal, 0.0025 franc ($0.00048) per ton-kilometer (0.621 mile).

### GHENT-BRUGES CANAL.

This canal is the only canal in this district navigable throughout its entire length, which is 44.68 kilometers (27.69 miles). The average annual expenditure for maintenance per kilometer (0.621 mile), including salary of canal guardians and bridge turners, is 1,700 francs ($328.10). The propulsion of boats along this canal is generally by men, women, children, horses, and steam tugs. Some boats, the number, however, is very limited, are provided with motors.

This canal allows the boats of a maximum tonnage of 700 tons. Very important works of enlarging, which will necessitate an expenditure of from 9 to 10 millions of francs ($1,737,000 to $1,930,000), are now under way of execution. Of the foregoing appropriation, 4 millions ($772,000) have already been disbursed and 17 kilometers (10.56 miles) of the total length have been completed.

The object of these improvements is to render the canal navigable for boats of a higher tonnage and of the Rhine type, which measure 100 meters (328 feet) in length, 12 meters (39 feet) in width and with a draft of 2.50 meters (8 feet). These vessels register a tonnage of about 1,800 tons.

The width of the bottom of the canal will be 18 meters (59 feet), with a depth of 3 meters (10 feet) at low water in summer and about 3.30 meters (11 feet) in winter. The slope of the banks will be eight-fourths under water, and six-fourths above water line. The width of 18 meters (59 feet) on the bottom will allow boats of 12 meters (43 feet) in width of the Rhine type to pass boats and barges of a width of 5 meters (16 feet), with a draft of 2.10 meters (7 feet) and a total tonnage varying from 300 to 350 tons.

Every 3 kilometers (1.86 miles) or more the canal will be enlarged to permit the safe passage of larger boats. The width of the canal on the bottom at these points will be 26 meters (85 feet). In the curves the bottom will present a width calculated according to the formula $\frac{2900}{R}-$, R being the radius of the curve. The junction with the normal section will be made over a length of L+l toward the exterior, and $\frac{L+l}{2}$ toward the interior tangent point of the curve, L and l being the half length of the boats passing one another.

The different divisions of the canal will be able to communicate with one another by telephone connections, which will be installed along the entire length of the canal. The locks will be worked by hand power.

### GHENT-TERNEUZEN CANAL.

The Ghent-Terneuzen Canal is considered as one of the most important canals of this country. It has a total length of 32.82 kilometers (20⅜ miles), of which 10⅘ miles are on Belgian territory and

9⅜ miles on Dutch territory. The canal is crossed by 11 bridges of modern construction. On the entire Belgian section the width at the water line is 318 feet, while the bottom has 78 feet. On Dutch territory the width is 219 feet with 78 feet on the bottom and a uniform depth of 27 feet. The locks and bridges are all worked by electricity. The locks at Terneuzen will allow ships of a total length of 577 feet with a draft of 27 feet to enter the canal at high tide.

The canal is, strictly speaking, considered as a maritime canal and is principally used for international traffic connecting the port of Ghent with the North Sea. Regular steamship lines now ply between this port and other European ports.

## TRANSPORTATION CHARGES ON INLAND WATERWAYS.

A careful investigation of the transportation charges on inland waterways, when compared with transportation by rail, shows that the former are almost in every instance approximately 50 per cent lower than the latter. Water-borne traffic is increasing from year to year. The Ghent-Bruges Canal and the River Scheldt are the two principal waterways for traffic as they form a complete connection between the cities of Ghent, Bruges, and Antwerp. The principal commodities transported on these waterways are coal, rags and paperstock, threads and yarns, cotton, plants and miscellaneous other wares and merchandise. The distance from Ghent to Bruges by water is 50 kilometers (31 miles), while transportation charges of regular articles are as follows: Coal, 3.50 francs ($0.68) per ton; wastes, 5 francs ($0.97) per ton; threads, 4 francs ($0.77) per ton; plants, 0.75 to 2 francs ($0.14 to $0.39) per basket, according to size.

The principal wares and merchandise transported from the city of Ghent to Antwerp, a distance of approximately 100 kilometers (62.13 miles) by the River Scheldt, are the following: Linen and cotton goods, 5.50 francs ($1.06) per ton; chemical products, 3 francs ($0.58) per ton; cement, 2.50 francs ($0.48) per ton; paper, 2.50 francs ($0.48) per ton; nails, 2 francs ($0.39) per ton.

On the other hand, the article principally transported by inland waterways from Antwerp to Ghent is raw cotton, principally from India and the United States. The transportation charges are as follows: American cotton, 3 francs ($0.58) per ton; India cotton, 2.50 francs ($0.48) per ton.

## RIVER NAVIGATION.

The following table shows the total number of boats with tonnage entering the docks and fore-harbor of the city of Ghent since the year 1900 to 1908, inclusive. All of these boats have paid wharfage dues to the city.

| Years. | Number. | Tonnage. | Years. | Number. | Tonnage. |
|---|---|---|---|---|---|
| 1900 | 4,480 | 650,182 | 1905 | 4,794 | 902,744 |
| 1901 | 3,994 | 692,980 | 1906 | 4,333 | 967,421 |
| 1902 | 4,695 | 828,395 | 1907 | 5,829 | 919,248 |
| 1903 | 4,603 | 813,673 | 1908 | 6,066 | 1,113,416 |
| 1904 | 4,687 | 899,435 | | | |

From the foregoing table it will be seen that the tonnage since 1900 has almost doubled, while the number of vessels shows an increase of 1,586.

The following table shows the number and tonnage of boats arriving in and leaving the port of Ghent through the rivers Scheldt and Lys and the Ghent-Bruges Canal from the year 1903:

| Years. | Arrivals. | | Departures. | |
|---|---|---|---|---|
| | Number. | Tonnage. | Number. | Tonnage. |
| 1903 | 11,410 | 1,835,827 | 12,983 | 1,637,729 |
| 1904 | 11,069 | 1,950,351 | 11,337 | 1,870,028 |
| 1905 | 12,014 | 2,144,674 | 11,654 | 2,023,282 |
| 1906 | 12,162 | 2,033,377 | 11,157 | 2,070,163 |
| 1907 | 12,452 | 2,378,040 | 13,041 | 2,460,819 |

## WIDTH AND DEPTH OF RIVERS AND CANALS.

The prevailing width and depth of canals and rivers located in this district are the following:

*River Scheldt, division Ghent-Audenaerde-Berchem.*—Width at bottom, 7 to 15 meters (23 to 49 feet); depth, 2.10 meters (7 feet) in summer; depth, 2.50 meters (8 feet) in winter; maximum length of boats allowed, 41.20 meters (135 feet); maximum width of boats allowed, 5 meters (16 feet).

*River Scheldt, division Termonde to Ghent.*—Width at bottom, variable; depth 1.90 to 5 meters (6 to 16 feet) without any guarantee.

*River Lys.*—Width at bottom, 10 meters (33 feet); depth, 2.10 meters (7 feet) in summer; depth, 2.40 meters (8 feet) in winter; maximum length of boats, 41.15 meters (135 feet); maximum width of boats, 5 meters (16 feet).

The type of boat most commonly used shows a tonnage of about 320 tons with a draft of 1.80 meters (7 feet).

The port of Ghent offers all facilities for the transfer of freight from boats to railway, the latter running alongside the vessels, thus enabling the transfer from the vessel direct on to the railway cars.

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## Supplemental to Foregoing Report.

In 1902 a commission was appointed for the purpose of making a thorough investigation regarding works of improvement to be carried out on the Bruges Canal with a view to rendering this canal navigable for boats of a greater tonnage. This commission finally decided to adopt the system "Villa" for the protection of the banks of the canal.

It should, however, be remarked that the opinion of the most important contractors of hydraulic works as to the efficiency of this system greatly differs from that of the Government engineers.

## Appendix I.

*Receipts and expenditures of the navigable waterways of Belgium.*

| Years. | Length of state system. | Expenses. | | | Receipts from the waterways. |
|---|---|---|---|---|---|
| | | Ordinary (maintenance, general improvement, new plants, boats, etc.). | Extraordinary (special expenses for construction, damages, etc.). | Total. | |
| | *Kms.* | *Francs.* | *Francs.* | *Francs.* | *Francs.* |
| 1831–1840 | 808 | 4,538,650 | 9,397,630 | 13,936,280 | 12,798,280 |
| 1841–1850 | 1,180 | 12,582,590 | 17,680,430 | 30,263,020 | 27,889,250 |
| 1851–1860 | 1,420 | 14,750,160 | 37,139,270 | 51,889,430 | 28,814,290 |
| 1861–1870 | 1,635 | 14,350,550 | 62,252,370 | 76,602,920 | 20,690,550 |
| 1871–1880 | 1,635 | 23,361,200 | 90,234,080 | 113,595,280 | 15,992,420 |
| 1881–1890 | 1,700 | 23,484,080 | 70,337,620 | 93,821,700 | 13,859,190 |
| 1891–1900 | 1,800 | 21,248,260 | 46,232,270 | 67,480,530 | 14,477,316 |
| 1901 | 1,800 | 2,286,448 | 7,464,853 | 9,751,301 | 1,590,897 |
| 1902 | 1,800 | 2,182,666 | 10,535,189 | 12,717,855 | 1,703,218 |
| 1903 | 1,800 | 2,146,454 | 16,250,389 | 18,396,843 | 1,901,594 |
| 1904 | 1,800 | 2,242,136 | 16,414,514 | 18,656,650 | 1,994,640 |
| 1905 | 1,800 | 2,271,334 | 11,311,539 | 13,582,873 | 1,972,058 |
| 1906 | | 5,139,087 | 14,463,505 | 19,602,592 | 2,045.929 |
| 1907 | | 2,974,600 | 10,588 623 | 13,533,223 | [1] 2,008,591 |
| | | | | 553,830,497 | 147,738,223 |

Receipts up to and including Dec. 31, 1907, the closed season not yet having begun.

## Appendix II.

### TRAFFIC ON INLAND WATERWAYS.

The amount of traffic transported on the inland waterways of Belgium for the years 1880–1907 is as follows:

| | *Ton-kilometers.* | | *Ton-kilometers.* |
|---|---|---|---|
| 1880 | 434,000,000 | 1903 | 1,035,000,000 |
| 1890 | 578,000,000 | 1904 | 1,092,000,000 |
| 1900 | 894,000,000 | 1905 | 1,143,000,000 |
| 1901 | 852,000,000 | 1906 | 1,154,000,000 |
| 1902 | 918,000,000 | 1907 | 1,198,000,000 |

During this period 1880–1907 the traffic increased 176 per cent.

The following table shows the tonnage of the four principal groups of commodities carried by water for the years 1901 and 1907:

| Nature of commodity. | 1901 | 1907 |
|---|---|---|
| | *Ton-kilometers.* | *Ton-kilometers.* |
| Coal | 224,993,297 | 323,908,784 |
| Minerals, building material, pottery, etc | 309,042,337 | 446,656,233 |
| Wood, agricultural products | 173,494,977 | 236,070,363 |
| Miscellaneous | 144,606,894 | 191,659,850 |
| Total | 852,137,505 | 1,198,295,230 |

## Appendix III.

*Traffic on inland waterways of Belgium.*

| Year. | Anvers to the Rhine. | The Rhine to Anvers. | Total. |
|---|---|---|---|
| | *Tonnes.* | *Tonnes.* | *Tonnes.* |
| 1900 | 1,203,097 | 1,322,536 | 2,525,633 |
| 1901 | 1,306,707 | 1,450,563 | 2,757,270 |
| 1902 | 1,508,835 | 1,479,388 | 2,988,223 |
| 1903 | 1,573,881 | 2,212,088 | 3,785,969 |
| 1904 | 1,750,657 | 2,353,669 | 4,104,326 |
| 1905 | 1,978,117 | 2,457,463 | 4,435,580 |
| 1906 | 2,012,824 | 2,808,405 | 4,821,229 |
| 1907 | 2,246,445 | 2,691,241 | 4,937,736 |

*Traffic to Holland.*

| Year. | Importations. | Exportations. | Total. |
|---|---|---|---|
| | *Tonnes.* | *Tonnes.* | *Tonnes.* |
| 1903 | 4,431,571 | 4,445,003 | 8,876,574 |
| 1904 | 4,400,795 | 4,829,072 | 9,229,867 |
| 1905 | 4,825,974 | 4,983,454 | 9,809,428 |
| 1906 | 5,200,932 | 5,188,764 | 10,389,696 |

*Traffic to France.*

| Year. | Importations. | Exportations. | Total. |
|---|---|---|---|
| | *Tonnes.* | *Tonnes.* | *Tonnes.* |
| 1903 | 777,859 | 2,300,252 | 3,078,111 |
| 1904 | 855,488 | 2,270,741 | 3,156,229 |
| 1905 | 983,224 | 2,011,949 | 2,994,273 |
| 1906 | 915,434 | 2,160,334 | 3,075,768 |
| 1907 | 1,197,053 | 1,974,470 | 3,171,523 |

## Appendix IV.

*Commerce of Belgium.*

| | 1905 | 1906 | 1907 |
|---|---|---|---|
| General commerce: | *Francs.* | *Francs.* | *Francs.* |
| Importation | 4,989,000 | 5,725,000 | 6,123,000 |
| Exportation | 4,259,000 | 5,062,000 | 5,191,000 |
| Total | 9,245,000 | 10,787,000 | 11,314,000 |
| Special commerce: | | | |
| Importation | 3,068,000 | 3,454,000 | 3,773,000 |
| Exportation | 2,333,000 | 2,793,000 | 2,848,000 |
| Total | 5,402,000 | 6,247,000 | 6,621,000 |

The following table for the year 1907 shows that Belgium occupies fifth place in its commerce from the point of view of absolute value and first place if the value per 1,000 of population is considered.

| Country. | Population. | Special commerce. | Value of commerce per 1,000 of population. | Rank of importance of countries— | |
|---|---|---|---|---|---|
| | | | | According to absolute value of commerce. | Per 1,000 of population. |
| | | *Francs.* | *Francs.* | | |
| Belgium | 7,317,561 | 6,621,000 | 905 | 5 | 1 |
| England | 44,538,718 | 29,095,000 | 652 | 1 | 2 |
| Germany | 63,255,000 | 19,497,000 | 308 | 2 | 3 |
| France | 39,337,235 | 11,590,000 | 295 | 4 | 4 |
| United States | 85,817,239 | 17,177,000 | 200 | 3 | 5 |
| Italy | 33,640,710 | 4,496,000 | 135 | 7 | 6 |
| Austria | 49,784,301 | 5,207,000 | 105 | 6 | 7 |
| Russia | 124,655,800 | 4,490,000 | 36 | 8 | 8 |
| Holland | 5,672,237 | [1] 10,348,000 | 1,824 | ..... | ..... |

[1] Some very careful calculations permit it to be said that the special commerce of Holland is, strangely enough, less than half the amount given here according to the official statistics. (Universal Statistics, 1908.)

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# REPORTS OF ARMY ENGINEERS

UPON THE

# PROPOSED CANALS CONNECTING LAKE ERIE WITH THE OHIO RIVER AND WITH LAKE MICHIGAN

WASHINGTON
GOVERNMENT PRINTING OFFICE
1911

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# REPORTS OF ARMY ENGINEERS UPON PROPOSED CANALS.

## REPORT ON THE PROPOSED CANAL FROM LAKE ERIE TO THE OHIO RIVER.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
*Washington, June 10, 1911.*

Hon. T. E. BURTON,
*Chairman National Waterways Commission,*
*United States Senate.*

SIR: 1. In compliance with your letter of May 5, 1911, I have the honor to forward herewith report submitted by Lieut. Col. H. C. Newcomer, Corps of Engineers, in reference to the proposed canal from Lake Erie to the Ohio River. The views expressed in the report are necessarily subject to revision in the light of more complete data and, with this reservation, I am in general accord with them.

2. In view of the national importance of the proposed waterway it is believed that arrangement might properly be made for the planning and supervision of the work by officers of the Corps of Engineers and for some degree of cooperation by the United States in construction; this to be dependent upon the results of a complete investigation as to the importance of the canal to general navigation. Such cooperation would probably include construction of the harbor in Lake Erie and the improvement of the rivers in the Pittsburgh district found actually necessary; but in determining the improvement to be made, careful consideration should be given to the relative advantages of a 9-foot navigation, such as is now provided for on the Ohio River, and that which is economically possible through the projected canal with the dimensions proposed.

3. While, as stated above, it is believed desirable and proper that the work should be planned and executed under the supervision of officers of the Engineer Corps, the details of the legislation providing for such an arrangement would require careful consideration, for if the funds furnished by the State or local agency for the execution of the work were deposited in the Treasury of the United States, as in the usual case, and the work executed as an improvement by the United States, it would be subject to the restrictions of the eight-hour law, civil service, and department regulations, which would serve to materially increase the cost of the project.

Very respectfully,

W. H. BIXBY,
*Chief of Engineers, United States Army.*

War Department,
United States Engineer Office,
2111 Farmers Bank Building,
*Pittsburgh, Pa., June 8, 1911.*

The Chief of Engineers, United States Army,
*Washington, D. C.*

Sir: 1. In compliance with instructions contained in department letter of May 12, 1911 (E. D. 72788/586), I have the honor to submit the following remarks concerning the proposed Lake Erie and Ohio River ship canal in response to the four questions stated in the letter and repeated in the headings given below. This report is made at the present time without awaiting an opportunity for more complete investigation of the subject, as you notified me by telephone on June 6 that you would like to have me submit such statement as might be practicable by June 8.

2. Promptly upon receipt of the department's instructions permission was obtained from the president of the canal company for necessary conferences with the canal engineers. These are Mr. George M. Lehman, chief engineer, and Messrs. Emil Swensson and T. P. Roberts, consulting engineers. The records of the canal company have been stored away for several years, and it requires considerable time to find the detailed information necessary for a study of the project, so that but little progress has been made. I had expected to make a preliminary report next week before starting for Europe, to be followed by a more complete discussion after my return in the fall. The subject is one of very great importance, involving an expenditure of more than $50,000,000, and should receive much more prolonged study than I have been able to give it up to the present time.

3. The route of the canal extends from the Ohio River at Beaver, Pa., along the Beaver and Mahoning Rivers to Niles, Ohio, and thence along the valley of Mosquito Creek to the summit level, and along the valley of Indian Creek to Lake Erie at a point 7 miles west of Ashtabula, Ohio. It has a length of 103 miles with summit level 232 feet above pool 6, Ohio River, and 327 feet above Lake Erie, giving an average lift of 5.4 feet per mile. The plans provide for a canal section of about 2,000 square feet, having a depth of 13 feet, with 12 feet on lock sills; bottom widths of 131.25 feet in earth, 153 feet in rock, and 175 feet in the river section, and surface widths of 175 feet and 155 feet in earth and rock, respectively. There are 30 locks with available dimensions of 56 by 360 feet, having lifts varying from 9 to 25 feet, with average of about 18.6 feet. The limiting curvature of the line as located is generally under 4°, but there is one curve in the Mahoning River section of about 6°, where the canal section, however, has been considerably widened to facilitate the movement of fleets.

4. Questions (*a*), (*b*), (*c*), and (*d*) will now be taken up in the order indicated.

(*a*) Whether the reports, plans, and estimates appear to be reasonably complete as to commercial statistics, present and prospective, and reasonably correct as to cost and time of construction.

5. A very good general report of the proposed work has been issued as a "Prospectus" of the Lake Erie and Ohio River Ship Canal.

This is in a printed cloth-bound pamphlet of 50 pages, accompanied by 3 maps (extracts from which are given in Appendix A). This report, with some exceptions to be noted later, is reasonably complete as to commercial statistics, present and prospective, and reasonably correct as to cost and time of construction, but the plans and estimates are not given in sufficient detail in this report to enable one to judge whether they are adequate. Upon consulting the engineers connected with the work it is found that no reports covering the technical features of the particular canal now under consideration has ever been made aside from the one mentioned above. A great deal of information has been collected to serve as a basis for the plans and estimates but no complete detailed statement or analysis of these data has been prepared, such as is usually required for works of great magnitude in order to convince an engineer that the technical features of the project have been fully treated. The "Prospectus" has been very carefully prepared, however, and the well-known ability of the engineers connected with the work warrants a high degree of confidence in their statements. Moreover, there are two former published reports of investigations along similar lines that contain much valuable information. One is the report of the Pennsylvania Canal Commission, appointed in 1890, on a canal route along the Beaver and Shenango Rivers to Conneaut Harbor, Lake Erie, and the other is a report of the provisional committee of the Pittsburgh Chamber of Commerce, appointed in 1895, on a route from Davis Island Dam along the Ohio, Beaver, and Mahoning Rivers to Ashtabula. The latter includes a report of a board of advisory engineers, consisting of Gen. H. L. Abbott, Lewis M. Haupt, and N. H. Hutton, who heartily indorse the project.

6. The surveys that have been made have doubtless been sufficient for a preliminary study of the work, but it is thought that they are not complete enough for making final estimates and plans. In 1895 maps were made on a scale of 1,600 feet to the inch covering the summit level, the Pymatuning Reservoir, and the feeder from French Creek, and other maps on a scale of 400 feet to the inch covering the Beaver and Mahoning River sections of the canal. At that time the proposed Lake Erie outlet was at Ashtabula. In 1905 some additional surveys were made on a scale of 200 feet to the inch, on which the official locations of the canal line and the French Creek feeder, as adopted by the canal company, were indicated. These surveys included accurate transit and level lines along the proposed locations, and 5-foot contours determined by hand level in the vicinity of these lines throughout the greater portion of their length. The canal engineers also have copies of the field sheets of the United States Geological Survey for certain portions of the route on a scale of 4,000 feet to the inch. There are profiles of the canal and of the French Creek feeder on a scale of 400 feet to the inch horizontally and 15 feet to the inch vertically. The estimate sheets for excavation show cross sections at variable distances from 100 to 1,000 feet or more apart. The quantities were determined by multiplying the mean of the end areas by the distance between sections. No borings were made to determine the presence of rock, but considerable data were collected concerning both drilled and dug wells in the vicinity of the work, which were considered to give fairly reliable indications as to the level of the underlying rock floor. One of the doubtful

elements concerning the quantities is probably in connection with the assumption as to the amount of rock to be excavated.

7. The estimate of cost for the work is given in some detail on pages 35 and 36 of the "Prospectus" and the unit prices on pages 37 and 38.[1] These are taken from a much more complete and detailed estimate of 50 foolscap pages in typewritten form which has not been published. Even in this completer form it is hardly possible to form a satisfactory opinion in such a limited time as to the adequacy of the estimates without more thorough field inspection and fuller information than appears in any report relating to the project. The estimates appear to have been very carefully considered and may prove to be adequate, especially if the 8-hour law does not apply, but I am inclined to believe that the unit prices should be increased somewhat. On the other hand, I believe that the allowance for highway and railroad bridges may be excessive, as the proposed heights of 45 feet and 40 feet on the river and canal divisions, respectively, are considered greater than necessary. A height somewhere between 20 and 30 feet would probably be ample for the types of boats that would use the canal. The estimates for right of way and land for reservoirs are thought to be too low. They call for a total of 29,391 acres at an average price of $41.53 per acre.

8. The data furnished concerning the water supply show that this very essential feature of the project is capable of satisfactory treatment. The surplus run-off from the areas that can readily be made tributary to the summit level is sufficient for all probable needs. It is questioned, however, whether the existing plans for the French Creek feeder make adequate provision for controlling the supply from that source. It is believed that the section of the feeder would have to be enlarged to give greater capacity during flood periods, or else storage reservoirs would have to be built in the French Creek Basin. Either plan would, of course, increase the estimate of cost.

9. Opposite page 18 of the "Prospectus" is given a sample balance sheet with financial statement or estimate of cost, tonnage, revenue, etc., covering the five-year period of construction and 10 years of operation.[2] It will be noted that while the total estimate for cost of construction given on page 36 is $49,984,000, the total expenditures during the period of construction, including interest on bonds, is given in the balance sheet as $53,061,339. Moreover, a further issue of stock amounting to $3,722,836 is required to cover deficiency of revenue during the first two years of operation, giving a grand total to be derived from the sale of stocks and bonds amounting to $56,784,175. It is believed that the estimated tonnage is greater than can be confidently expected, so that it is probable that a longer period would elapse before the income would pay the operating expenses and interest on bonds.

As a considerable further detailed study will be required in the preparation of plans and estimates before work of construction can begin, it is also believed that a longer period than five years will be required to complete the work from the time it is undertaken. Some provision should doubtless be made in the estimate for purchase of the charter rights, maps, plans and other data of the Lake Erie & Ohio River Ship Canal Co. In view of the above considerations it

[1] See Appendix A, p. 34.

[2] See Appendix A, p. 28.

is believed that a careful study and revision of the estimates would give a total of at least $53,000,000 for the cost of building, and further payments for interest on bonds until the canal becomes self-supporting, that would run the grand total up to more than $60,000,000 that would be required to finance the work if it is built on the projected lines.

10. It is to be noted that the estimate does not provide the outer harbor at the lake entrance to the canal, which the Government is expected to build and for which no estimate has been made, nor does it provide for deepening the channel in the Ohio, Monongahela, and Allegheny Rivers to accommodate boats of 12-foot draft.

11. The dimensions proposed for this canal are greater than those adopted for the New York State Barge Canal. In view of the conclusions reached with reference to the depth of the proposed waterway from Lake Michigan to the Gulf and the depths now being provided on the rivers in the Pittsburgh district, it is believed that a careful study should be made as to whether the depth of 9 feet, with smaller locks, would not be more desirable than the plan now proposed.

(*b*) What is the prospect of the work being of value to the country or community or parties paying for the same, sufficient to justify its cost?

12. Under the existing freight rates for the transportation by rail of iron ore and coal between the Pittsburgh district and Lake Erie, it is believed that there would be sufficient traffic on the canal in these two commodities to pay a reasonable rate on the capital required for the construction of a canal of suitable dimensions. It is thought that the estimates of tonnage in the "Prospectus," pages 9 to 11, giving about 21,000,000 tons of ore shipped from the lake to the Pittsburgh and other districts immediately tributary to the canal, and about 13,000,000 tons of coal shipped from the Pittsburgh district to the lake, are conservative estimates for the present movements of these commodities.[1] There is no other route in the country where the existing commerce is so favorable for the development of a heavy canal traffic, and there is reason to expect a still larger development of this commerce in the future. The blast furnaces using the ore are, in nearly all cases, quite close to existing navigable waterways or on the line of the proposed canal. Their ore yards are now equipped with more or less expensive plants for handling shipments by rail. Advantageous arrangements could doubtless be made in most cases for receiving shipments by water, though in some cases the distance from the stock pile to the waterway and the existence of intervening buildings would require plants of greater cost than usual to make suitable connection with the waterway. The situation is not so favorable for coal. It is understood that most of this now goes to the lake from mines that are not on a navigable waterway, and it is doubted whether rail shipments would be diverted to the waterway under such circumstances.

13. Existing freight rates are very high, amounting to 8.93 mills per ton-mile for ore and 6.93 mills per ton-mile for coal, as shown on page 16 of the "Prospectus." On the other hand it is stated on page 18 of the "Prospectus" that the cost of shipping ore on the

[1] See Appendix A, p. 21.

Bessemer & Lake Erie Railroad is only 2.8 mills per ton-mile, while on the ship canal it is estimated at 1.58 mills per ton-mile.[1] The average canal rates including tolls are estimated at 32½ cents per ton, or about 3 mills per ton-mile. It is believed that the charge of 1.58 mills for transportation on the canal is underestimated. I should be inclined to make it not less than 2 mills per ton-mile. The shippers in the Pittsburgh district complain of the present exorbitant rail rates. It is understood that coal is now being shipped to lake ports from other coal districts for less than 4 mills per ton-mile and in some instances for less than 2½ mills per ton-mile. While it is thought that the saving in canal rates compared with existing and even somewhat reduced freight rates would be sufficient to justify the construction of the canal, if this were necessary in order to get the low rates, it is believed that if the canal were built the rates on the railroads would be reduced to such a point that the saving in shipment by canal would in many cases fail to warrant the shippers in giving up rail transportation. It is very doubtful, therefore, in my opinion, whether there would be sufficient commerce on the canal to provide a revenue commensurate with the expense of the work. If the canal were free of tolls it would doubtless carry much more commerce and would save shippers considerable money, just as it would save them considerable money if the railroad lines with their rights of way were provided for their use without any charge upon the traffic.

14. There will, of course, be indirect benefits attending the construction of the canal that might go far toward paying its cost of construction. The provision of such a waterway would probably lead to the establishment of numerous mills along its line that would greatly enhance the value of real estate and promote industrial development that would be of great importance to the communities concerned. It is doubtless on some such basis as this that the New York State Barge Canal is being built, at enormous expense, to be operated without any toll charges. It is possible that a few years' experience with this barge canal may afford reliable indications of the success that would attend the Lake Erie & Ohio River Ship Canal.

(*c*) What conditions, if any, of cooperation would seem to be proper between the local interests and the Federal Government in the matter, either in the way of assistance by funds for construction or maintenance, or by other arrangement?

15. It is understood, so far as the canal itself is concerned, that the proposition now before the National Waterways Commission, submitted by the local interests, is to the effect that the communities interested will provide all of the funds necessary for the construction of the canal, and the Federal Government will simply cooperate to the extent of having the work planned and built under the supervision of Government engineers. It is desired, however, that the Government should provide a harbor at the lake end of the canal and necessary improvements on the rivers in the Pittsburgh district. It is probable that the Government would be justified in cooperating to the extent indicated, though inquiry should first be made as to whether the canal could not be made to conform in depth with improvements now under way on the Ohio River. On the other hand, if a thorough

[1] See Appendix A, p. 27.

study of the subject leads to the conclusion that the construction of the canal is advisable, it is believed that the general policy hitherto adopted by the Government would warrant even further cooperation by providing part of the funds required for its construction and maintenance. There can be no doubt that the work would be of national importance.

(*d*) As to the desirability of work being entirely or partially done under direct orders or supervision of Engineer Department officers.

16. It is understood that local interests desire the work to be done under the direct orders and supervision of officers of the Corps of Engineers in the same manner as other works of navigation are conducted by the War Department. To adopt this course would doubtless establish a precedent that would lead to similar requests for Government supervision of work being undertaken in other parts of the country primarily for the promotion of local interests and in many cases it would be inadvisable for the Government to lend such assistance. On the other hand, this project is believed to be one of very great importance and of sufficient national concern to warrant the Government in giving such assistance, if the work is undertaken, and it is therefore considered desirable that the work be placed in charge of the officers of the Corps of Engineers. Any legislation providing for such cooperation, however, should direct that the work shall not be undertaken in this manner until it has received thorough study and approval by the Government and that the plans shall be subject to approval by the Chief of Engineers and the Secretary of War.

Very respectfully, your obedient servant,

H. C. Newcomer,
*Lieutenant Colonel, Corps of Engineers.*

8293—11——2

## REPORT ON THE PROPOSED CANAL FROM LAKE MICHIGAN TO LAKE ERIE.

UNITED STATES ENGINEER OFFICE,
*Chicago, Ill., July 26, 1911.*

The CHIEF OF ENGINEERS, UNITED STATES ARMY,
*Washington, D. C.*

SIR: 1. In accordance with instructions contained in letter from your office dated March 18, 1911, I have the honor to make the following report on the proposed canal, Lake Erie to Lake Michigan, by way of Maumee River and Fort Wayne, Ind. Your instructions were that this report should contain such description of routes, approximate estimates of cost, etc., as can be made up from information on hand or readily available to this office. Reference is made in your letter to provision in section 4 of the river and harbor act of February 27, 1911, authorizing the National Waterways Commission to call upon your office for engineering data relative to certain canal routes. The canal route from Lake Erie to Lake Michigan is mentioned in that section in the following language:

> Second, the proposed canal from Lake Erie, by way of the Maumee River and Fort Wayne, or other direct and feasible route to the southerly end of Lake Michigan.

2. Section 4 of the act of February 27, 1911, contains also the following language:

> Said commission is also authorized to investigate and report upon the advisability and feasibility of proposed artificial waterways * * * including the following: * * * Second, * * * for the obtaining of the necessary engineering data the commission is authorized to call upon the Corps of Engineers. * * *

From the language of the act and from your instructions it is understood that I am to prepare a report covering only the engineering features of a canal from Lake Erie to Lake Michigan.

3. So far as I can ascertain no survey has ever been made either by the Government or by private interests for the definite purpose of determining the best route or location, with estimates of cost, etc., for a canal to connect Lake Erie with the southerly end of Lake Michigan. Four governmental surveys have, however, been made for canals connecting other waterways, parts of which surveys would be useful in determining the best and most feasible route from Lake Erie to Lake Michigan. One of these surveys, and that the first one in order of time, fulfills the condition mentioned in the act of February 27, 1911—"by way of the Maumee River and Fort Wayne"—in that one of the routes then surveyed began at the southerly end of Lake Michigan and terminated at Fort Wayne.

4. The first survey in order of time was made in 1829 and 1830 by Mr. Howard Stansbury, United States assistant civil engineer,

"to ascertain the practicability of uniting by a canal the waters of Lake Michigan with the Wabash River." Mr. Stansbury's report, printed in Document 143, Twenty-second Congress, first session, states that—

by the instructions issued by the board of internal improvements, two routes were ordered to be examined and compared, which are therein described as follows, viz:

1. The first would ascend the valley of the St. Joseph River (of the lake) to leave it at a convenient point near to Kankakee River: then it would cross to this stream to descend its valley down to the mouth of Yellow River; thence up to the same to a point from which a cross canal could be run to Tippecanoe River. From thence the route descends this stream, and then the Wabash, to the head of steamboat navigation.

2. The other would ascend the valley of the St. Joseph River (of the lake) up to one of its head branches; from thence to the fork formed by the St. Joseph and St. Mary's Rivers; then from that point, through the valley of Little River, to the Wabash River, as far down as the head of steamboat navigation.

Both of these routes were surveyed and the plans, profiles, and field notes accompanied the report. As Fort Wayne is located at the "fork formed by the St. Joseph and St. Marys Rivers," the second route is of interest in the present examination.

5. The second survey was made in 1875, in pursuance of the act of March 3, 1875, directing an "examination for a route for a canal from Lake Michigan to the Wabash River, Indiana." The report on this survey, made by Maj. G. L. Gillespie, Corps of Engineers, United States Army, appears in the Annual Report of the Chief of Engineers for 1876, page 454, Part II. Maj. Gillespie reports (p. 460):

If we are to confine our attention strictly to the construction of a canal to be used solely for commercial purposes, the line indicated by Capt. Stansbury is the true one, without any question.

The route referred to by Maj. Gillespie is the same as that numbered "1" in Mr. Howard Stansbury's report. The engineering data obtained by Maj. Gillespie over other routes is of value, however, in this examination.

6. The third survey was made in pursuance of the act of Congress approved June 14, 1880:

To ascertain the practicability and cost of construction of a ship canal from Lake Erie by the Maumee and Wabash Valleys, in the bed of the old Wabash and Erie Canal, or with any variations therefrom that may prove feasible, to the navigable waters of the Wabash River; also for a survey and estimate of cost of a similar canal from Junction City, on the Wabash and Erie Canal, to the Ohio River, by way of the Miami and Erie Canal * * *, the estimates in each case to be for a water channel and locks of the same size and capacity as those of the present enlarged Erie Canal in New York.

Maj. John M. Wilson's report on these surveys is printed in the Annual Report of the Chief of Engineers, 1881, Part III, page 2348. That portion of these surveys extending from Lake Erie by the Maumee and Wabash Valleys is useful in connection with the present examination.

7. The fourth survey was made in pursuance of the river and harbor act of August 19, 1894:

* * * To survey the Miami and Erie Canal, the Ohio Canal, and such branches thereof and such river and stream channels as may in their judgment form available portions of a continuous canal connecting the waters of Lake

Erie with the Ohio River through the State of Ohio, and to report as to the feasibility and advisability of improving and widening such canal to seventy feet at the water line, and deepening same to seven feet, and by the construction of new locks not less than one hundred and fifty feet in length and twenty-one feet in width, with a capacity for vessels of at least two hundred and eighty tons' burden * * *.

The portion of the survey thus authorized covering the Miami and Erie Canal from Lake Erie to Junction City is useful in the present investigation. The report on the fourth survey appears in Part V, Annual Report Chief of Engineers, 1896, page 2973, and in House Document No. 278, Fifty-fourth Congress, first session.

8. From the period when Capt. Stansbury's survey of 1829 was made, up to the present time, the conditions which affect the selection of a route for a canal connecting Lakes Erie and Michigan have changed materially. The physical features of the country to be traversed have not changed, but the settlement and growth of towns and cities, the commercial and industrial development and the construction of railway lines in the territory lying between the two lakes will have a great influence upon the choice of route, and a much greater influence upon its cost. In fact, the choice of route depends not only upon conditions as they now exist in that territory, but also upon conditions in all parts of the United States which are or may be affected by the movement of all classes of commodities through a Lake Erie-Lake Michigan Canal.

9. If the sole purpose of such a canal were to provide a water transportation route between the two lakes, it should follow a straight line, or, if the cost of construction could be materially reduced thereby, a line which deviated but slightly from a straight line.

10. If the purpose of the canal were to furnish not only a waterway connecting the lakes, but also a water transportation route connecting cities lying in the intermediate territory and also the territory lying to the south in the valleys of the Wabash and Ohio Rivers, the route selected would deviate very greatly to the south of a straight line between the two lakes. It is thus seen that the exact purpose for which the Lake Erie-Lake Michigan Canal is to be constructed must first be determined before the best route can be selected and estimates of cost, etc., be prepared. As to feasibility, each of the above surveys has determined that a canal is feasible, but no data is furnished as to the advisability of its construction. A brief description of those portions of the routes covered by the above-mentioned surveys which might be used to form part of a Lake Erie-Lake Michigan Canal will be of value.

11. Capt. Stansbury's northern route followed the St. Joseph River from its mouth in Lake Michigan to the Pigeon River, thence up the Pigeon River, thence through a chain of lakes to Fish Creek, thence down the St. Joseph to a point about 6 miles from its junction with the Maumee at Fort Wayne. For the purpose of making the survey and estimate of cost this route was divided into three sections: Eastern, middle, and western. The eastern section extended "from 6 miles above Fort Wayne to a little below the junction of the St. Joseph and the Maumee with Fish Creek." The middle section extended "from the mouth of Fish Creek to Deer Lake, on Pigeon River." The western section extended "from Deer Lake to the debouch of the canal into the St. Joseph of the Lake."

12. The summary of distances and cost is as follows:

| Section. | Distance. | Descent. | Locks. | Estimate. |
|---|---|---|---|---|
| Eastern | 31.1035 | 40.00 | 5 | $360,390.69 |
| Middle | 53.721 | 256.96 | 32 | 480,067.32 |
| Western | 92.1136 | 256.18 | 32 | 1,020,010.06 |
| Total | 177.1132 | 553.14 | 69 | 1,860,468.07 |

13. The eastern section began at its eastern end "at the head of the feeder for the contemplated canal to connect Lake Erie with the Wabash River as run under the direction of commissioners appointed by the State of Indiana," or a point 6 miles above Fort Wayne. The western section terminated at a point on the St. Joseph of the Lake 3 miles from Lake Michigan. The total length of the route from Fort Wayne to Lake Michigan would be 186.1132 miles, with a summit level in Pigeon Lake about 372 feet above Lake Michigan. The summit was found to be 395 feet above Lake Michigan. The exact level above mean sea level was not determined. From Lake Erie via the Maumee to Lake Michigan by this route was about 290 miles.

14. At the period when the above-outlined route was surveyed a portion of the region traversed was still in the hands of the Indians, and it was little known by white men. It is now known that a shorter route with a lower summit level is available; hence it is not necessary to go into further details of the route surveyed by Stansbury.

15. It is interesting to note, however, that Stansbury's report indicates that excavation along this line would be in sand, clay, and gravel, and that because of the great scarcity of stone it was proposed to construct all locks, dams, aqueducts, and culverts of wood, suitable timber being found in abundance.

16. In discussing that part of the line named the "southern route," which runs from South Bend southward, the report refers to the difficulty of crossing the "Kankakee prairie."

> This prairie, lying at an elevation of not more than 2 or 3 feet above the level of the river, is very wet and swampy even in the dry seasons and abounds in springs. The Kankakee runs through it without forming any bank for itself, occupying merely a bed sufficient for its waters in the dry season, and in spring and fall overflowing the whole country far and wide, and forming what is called "the Kankakee pond."

On account of this prairie, Stansbury's line was located—

> along the foot of the bluff, skirting the wide prairie through which that stream runs.

17. The survey of 1875 was made for the same purpose as that of 1830, i. e., a canal from Lake Michigan to the Wabash River. The report says:

> With Capt. Stansbury's survey before me, I decided upon changing my proposed initial point to Michigan City, Ind., at the mouth of Trail Creek. I selected that point because a good harbor is there, and the many interests concentrating there seemed to especially recommend it as a suitable point for a canal terminus, provided it was found practicable to cross the divide with a sufficient supply of water, to be derived from the interior. * * * For a practicable route for a canal to connect the waters of Lake Michigan with those

of the Wabash River, we are compelled to follow either the Trail Creek route, or that by the valley of the St. Joseph River, where there is abundance of water.

The cost of constructing these lines is about the same, but without prejudicing the claim of the former on the ground of impracticability, I am obliged to express my preference for the latter. Selecting then the St. Joseph route, the question arises: What direction shall be given to the line after leaving the summit, near South Bend? If we are to confine our attention strictly to the construction of a canal to be used solely for commercial purposes, the line indicated by Capt. Stansbury is the true one, without any question.

This line is Stansbury's southern route, which, as stated above, skirted the Kankakee prairie on its eastern side, crossed the Yellow River to the Tippecanoe River, and followed the Tippecanoe River to the Wabash. On this line the divide between the Kankakee and the lake at South Bend was found to be 127 feet above the level of Lake Michigan, and by means of moderate cuts and dams the summit level was carried to the Tippecanoe.

18. In addition to the St. Joseph and Trail Creek routes, Maj. Gillespie examined several others. The Coffee Creek route starting at Michigan City passed up Trail Creek one mile, thence south to the Little Calumet, thence from the mouth of Coffee Creek across the dividing ridge at 175 feet above Lake Michigan, thence down Crooked Creek across the Kankakee at Bush Ridge at an elevation of 70 feet above Lake Michigan, and connected with the Trail Creek route at the head of Monon Ditch. "This route is impracticable."

19. The Wolf Lake route ran from the Grand Calumet River across the divide near St. Johns and down that creek to the Kankakee River. "The summit is 105 feet above the level of Lake Michigan and is without any water supply, except the inferior supply to be gotten from Cedar Lake." At the crossing of the Kankakee River the elevation is about 40 feet above Lake Michigan.

20. The Trail Creek route started at Michigan City, passed up Trail Creek, thence over the divide with an elevation of 210 feet to the Little Kankakee, down the Little Kankakee, across the Kankakee at an elevation of 102 feet, thence southwest to the Monon Ditch and Monon Creek. The water supply for the summit level was believed to be adequate from lakes near La Porte, Ind. These routes are all shown on the map and cross sections accompanying Maj. Gillespie's report.

21. These two surveys show that the water supply was ample for a canal, and that the divide is not excessively high. They also show that the proper point for the origin of a Lake Michigan-Lake Erie Canal at the southern end of Lake Michigan is either Trail Creek or the St. Joseph River.

22. The survey made in 1880 was, as already stated, for a ship canal from Lake Erie by the Maumee and Wabash Valleys. The report says:

In order not to interfere with the present large lumber business in the vicinity, to save about 3½ miles of canal and the rebuilding of several bridges and culverts and one aqueduct, and to avoid railroad complications, we have decided to enter the Maumee through Delaware Creek, and to use the river from thence to Toledo. From Delaware Creek the route of the present canal will be maintained to Fort Wayne * * * the high land, which divides the waters flowing southward into the Gulf of Mexico and eastward into the Gulf of St. Lawrence, is situated near that city, and for some distance to the west there is a swamp known as "Wet Prairie." This swamp has a length of about 10 or 12 miles and width of about 2 miles at its widest portion. The present canal follows along the edge of the morass and at points partly within it for

a distance of about 10 miles, beginning about 1½ miles west of the crossing of the St. Marys River. At Roanoke, 15 miles west of Fort Wayne, the summit level terminates with a lock of 10 feet lift. It is proposed to transfer a portion of the lift of this lock from Roanoke to a new one to be located nearer Fort Wayne, dropping the canal into the morass, and by the erection of a dam and construction of a short feeder to use the water from the St. Marys * * *.

The summit level at Fort Wayne was to be 190 feet above Lake Erie. The elevation of Lake Erie at Toledo is given in the Wilson Survey as 575 feet.

23. The report on the fourth survey says:

The Maumee River would be improved and followed for 4.5 miles above the present canal. The canal leaving the river 13 miles from Lake Erie would by a double flight of locks of 48 feet at once ascend to the level of the existing canal, which it would follow to Defiance. At this point and at Providence there are short slack-water stretches, but generally the canal would be along the river bank. After crossing the Maumee at Defiance it would ascend the valley of the Anglaise * * *. To summarize, the conclusions of the board are that it would be feasible to construct a canal of the dimensions specified in the act of Congress upon any of the three routes described in this report. * * *

24. When each of the above surveys was made, investigations were made of sources of water supply with the result that—

with these present and proposed reservoirs there would undoubtedly be an abundant supply of water at all times for purposes of navigation, and that a much larger amount could be stored if at any time required.—(Annual Report, Chief of Engineers, 1881, Part III, p. 2412.)

The required quantity of water was determined in 1880 by assuming the number of lockfuls per day at 100, equal to the passage of 150 boats, the locks to be 110 feet long and 18 feet wide, and the amount lost by filtration, evaporation, and leakage at 200 cubic feet per minute per mile of canal. In 1896 the loss was assumed as 100 cubic feet per mile per minute, excluding evaporation, the amount required for lockage at 170 lockfuls daily for 275 days in the year, and the evaporation as 35.75 inches from March 1 to November 30.

25. The surveys of 1830 and 1875 were made for a canal 40 feet wide at the surface, 28 feet at bottom, 4 feet deep, with a towpath of 10 feet, and guard bank 5 feet wide at the top, with locks 90 feet between the hollow quoins and 12 feet wide in the clear, the lift being 8 feet. The survey of 1880 was made for a canal 70 feet wide at surface, 52½ feet at bottom, with double locks 110 feet long, 18 feet wide, with a depth of 7 feet on the miter sill.

This will pass boats of 240 tons burden, capable of carrying 8,000 bushels of grain, the amount transported by a train of 20 ordinary freight cars.

The act of August 17, 1894, called for a canal 70 feet at the water line, 7 feet depth, locks 150 feet in length and 21 feet in width, with a capacity for vessels of at least 280 tons burden.

The report of the executive officer of the board covers the question of water supply and cost of construction for a canal having a uniform width of 85 feet and depth of 10 feet, which would admit the passage of vessels that might be considered of about the least practicable size for lake navigation.

26. The canal of 1830 was estimated to cost about $11,210 per mile; the canal of 1875, about $25,200 per mile; of 1880, about $88,355; of 1895, $100,460 (western route).

27. The Miami & Erie Canal had a minimum width of 40 feet at the water line, 26 feet at the bottom, and 4 feet depth. The locks were

single, 90 feet long, 15 feet wide, with a depth of 4 feet on the miter sill.

28. The section of the Wabash & Erie Canal from near the mouth of the Maumee to the junction was about 69 miles long, 60 feet wide at the surface, and 6 feet deep, and the ascent was made by 20 locks. * * * The cost of this section of the canal, a total length of 87⅞ miles, was * * * at the rate of about $35,000 per mile.—(Annual Report Chief of Engineers, 1881, p. 2351. See par. 48.)

29. It will be observed that the above-mentioned surveys have covered: First, a line up the St. Joseph River (of the lake), Pigeon River and St. Joseph or St. Joe River, a branch of the Maumee; second, a line from Michigan City east to the city of South Bend, thence south to the Wabash River; third, a line from Toledo up the Maumee and down the Wabash; fourth, a line from Toledo up the Maumee to the mouth of the Anglaise. So far as known to this office, no governmental exploration or survey has ever been made of the area inclosed within these four lines, nor of the area east of Pigeon River and north of the Maumee. The act of February 27, 1911, limits the location of the proposed canal as follows:

From Lake Erie, by way of the Maumee River and Fort Wayne or other direct and feasible route, to the southerly end of Lake Michigan.

The fixed points are, then, for the specified route, Lake Erie, the southerly end of Lake Michigan, the Maumee River, and Fort Wayne. The fixed points for the "other direct and feasible route" are Lake Erie and the southerly end of Lake Michigan. If we assume that Toledo and Michigan City should be the termini of the canal, a direct route would, therefore, pass through the region described above as unsurveyed. The distance from Toledo to Michigan City in a direct line is about 175 miles.

30. Stansbury's route via the Pigeon River passed over a high summit level. On account of the difficulties of water supply, as well as because of the great length of that line as compared to a direct line, another route should be selected, which, from available information, must be the Maumee River from Toledo to Fort Wayne or to a point near Fort Wayne. At the western end, with Michigan City as the terminal, it would seem best to follow a line eastward to South Bend with a view to avoiding the marshes of the Kankakee River. A fairly low level line could be found from South Bend to the Wabash River over lines surveyed in 1880 and thence up the Wabash Valley to Fort Wayne. The proportionally great length of such a route indicates the advisability of examining the country between South Bend and Fort Wayne for a more direct line with a low summit level.

31. The direct line between Toledo and Michigan City should not, however, be dismissed from consideration entirely because of a high summit level or insufficiency of water supply, for both might be overcome by the use of mechanical lift locks. Not only does the directness and comparative length of such a route give it an advantage over other less direct routes, but it also possesses the advantage of crossing a lesser number of trunk line railroads (as will be seen by an examination of the railroad maps of Indiana and Ohio) than other routes. If we eliminate from consideration the railroads crossing the Miami and Erie Canal between Toledo and Fort Wayne, a line from Fort Wayne to South Bend also possesses this latter advantage.

32. Engineering considerations alone, therefore, seem to indicate that the proper route for a canal from Toledo to Michigan City should either be on a direct line between those places or should follow the Maumee to Fort Wayne, thence to South Bend in a direct line and thence to Michigan City.

33. Commercial and transportation conditions in the territory lying between the two lakes also indicate that the latter route should be chosen. That is to say, the canal should pass through the manufacturing cities of South Bend and Fort Wayne and should connect with a future waterway between Lake Erie and the Ohio via the Miami or Wabash, which previous surveys have shown will necessarily be located near Fort Wayne.

34. The unsurveyed territory between Fort Wayne and South Bend, as shown on the only available maps, is covered by a large number of lakes forming the sources of streams flowing southward into the Wabash and northward into the St. Joseph. The watersheds of these two rivers are separated by a narrow divide having probably not much elevation above the Maumee at Fort Wayne. There seems to be no question that a practicable route can be found across this divide.

35. The lakes will afford a large quantity of water and reservoirs can be constructed to supply an additional quantity. We may assume with safety that a sufficient quantity can be impounded for a canal of the dimensions used in the survey of 1895.

36. It may also be assumed that a canal from Fort Wayne to South Bend would, under the conditions existing in 1895, cost no more than canals elsewhere, because the geological conditions are nearly the same. But the conditions existing to-day are so different from those of 1895 that any estimate of cost from available data would be unreliable; not only is there an unsurveyed area to be crossed by the canal, but the entire territory between Lake Erie and Lake Michigan is now traversed by steam and electric railroads not in existence in 1895, for which bridges must be provided where they would cross the canal; new water powers have been developed which would have to be acquired; the price of labor and materials has very largely increased.

37. Again, as having a serious influence upon cost of construction, the dimensions of a canal for the transportation of merchandise on an advantageous basis, as compared with other modes of transportation, must first be determined.

38. The distance from Chicago to Michigan City is 37 miles, from Michigan City to Toledo in a straight line is 175 miles, from Chicago to Toledo via the Straits is 674 miles. If we assume that the average speed of a ship on the lakes is 10 miles per hour and in a ship canal 4 miles per hour the time of passage from Chicago to Toledo via the Straits will be 67.4 hours, and via a canal assumed as 200 miles long will be 53.7 hours, or a gain by the canal of 13.7 hours.

39. The distance from Chicago to Buffalo via the Straits is 892 miles and via the canal would be 490 miles. The times of passage would be at the same rate of speed, 89.2 hours and 79 hours, or a gain of 10.2 hours. At 11 miles in the open lake the times are practically equal.

40. It would appear that, taking into consideration (1) the small gain in time of passage; (2) the great cost of a ship canal due to its large prism; (3) the necessity for drawbridges at all railroad, road,

and street crossings; (4) probably a deficiency in water supply; and (5) that cargoes for through shipment must be transferred at least once from canal boat or railroad to lake vessel, the idea of constructing a ship canal must be abandoned in favor of a barge canal.

41. It would also appear that the greatest advantage would be drawn from a barge canal with dimensions equal to or greater than those of the New York Barge Canal now under construction; so that barges loaded at Chicago or at points on Lake Michigan near Chicago could pass directly to New York without breaking bulk.

42. The distance from Toledo to Michigan City via the route outlined in paragraph 22 is about 215 miles. Along this line it is believed that there will be little or no excavation of rock required. The estimate of cost for the Miami and Erie Canal in 1896 was $100,460 per mile. Assuming a cost of $200,000 per mile, and a canal 215 miles long, with an enlarged cross section, the total cost would be $43,000,000; but, as previously stated, any estimate based upon present available data is little more than a guess.

43. While no governmental surveys have been made for a canal connecting Lakes Erie and Michigan, two examinations have been made by private individuals for such a canal which are worthy of mention.

44. Mr. Frank B. Taylor, of Fort Wayne, has written a pamphlet on the Michigan & Erie Canal and has furnished me with a supplementary statement on this same subject.[1] The information which he furnishes will be of value in connection with any survey for a canal which may be made at some future time. Their present value lies in the fact that they confirm the information already mentioned in this report. Mr. Taylor's supplementary statement is of such a character that it should be read as part of this report. It describes in general terms the various feasible routes for a canal and discusses their relative advantages and disadvantages, based upon geological data obtained from various sources. Mr. Taylor discussed the question of a route to Gary, Ind., giving to it the advantage of a relatively low cost for a long reach and an abundant water supply. From data given above it will be seen that this route will involve a heavy cut north of the Kankakee River and a heavy fill or aqueduct across the Kankakee Valley, besides intersecting many trunk-line railroads. If a survey is made, however, this route should be covered to determine its relative cost. It has the added advantage that, with the improvement of the Calumet River, a barge canal could be carried to Calumet Lake, inside the city limits of Chicago, and to Lake Michigan at Calumet Harbor, and in fact to the Chicago River, if the sanitary district of Chicago constructs its projected canal, known as the Sag Canal, connecting Calumet River with the present Sanitary District Canal.

45. Mr. W. T. Harris, of Chicago, has made an elaborate study for a Lake Erie-Lake Michigan canal from data obtained from various sources. A copy of his report and maps is inclosed herewith. Level lines were run from bench marks on railroad lines covering practically the entire line from Michigan City to Fort Wayne, and therefore, although a complete survey was not made, the data given in his report and his conclusions deserve consideration. He finds that a

[1] See Appendix B, p. 38.

summit level of 830 feet (249 feet above Lake Michigan) can readily be secured, with an abundant water supply, on a line passing through South Bend, Elkhart, Goshen, * * * Fort Wayne. His data is not sufficient to determine an estimate of cost of construction, but is quite sufficient to show that a canal is feasible on a line which is almost direct between South Bend and Fort Wayne.

46. Col. Millis, Corps of Engineers, in charge of the Cleveland district, has been directed to examine the Maumee River from Toledo to Fort Wayne. I am informed that he considers the river susceptible of canalization for a portion of its length, but that to carry a navigable waterway to Fort Wayne may require the use or improvement of the Miami & Erie Canal. A Lake Erie and Michigan canal, therefore, may terminate at some point on the Maumee River above Toledo.

47. There is inclosed herewith a map, furnished by the State geologist of Indiana, upon which are marked in blue the routes mentioned in the above paragraphs.

48. Some of the harbors and waterways mentioned above have been examined or surveyed and have been improved by the United States. A brief statement in each case is appended with references for further information.[1]

49. The water supply required for a Lake Erie-Lake Michigan Canal of adequate dimensions for the passage of barges of large size or lake steam vessels of present dimensions, and carrying a tonnage of only one-half its full capacity, will necessarily be large. It appears from statements made in paragraph 24 of this report, that the discharge of the various lakes and streams lying between Lake Erie and Lake Michigan, if properly impounded, will be sufficient for a barge canal. The construction of the necessary dams, reservoirs, canal feeders, etc., will give rise to questions of use and ownership of water power, drainage, and other rights now existing or created by those canal structures. The relative legal rights of the individuals and States affected, and of the United States, in the water required for the operation of a Lake Erie-Lake Michigan canal, and the money value of these rights, should be determined. In the canalization of a navigable waterway of the United States, the right of the United States to use the entire flow of water for navigation purposes is obvious. Its right to the water power created thereby, in excess of the amount of power required for the operation of the structures appurtenant to the improvement, is not clear, nor is its right clear to divert water from one navigable waterway into another, whether natural or artificial, without compensation to owners and users of the water in the first-mentioned waterway. Again, the ownership of waterpowers, etc., created by the diversion of water into the last-mentioned waterway must be determined.

50. The United States, on the other hand, possesses no right to the use of water flowing in nonnavigable streams, and its use for navigation purposes, whether returned to the same stream or diverted to another, must be paid for. The use of such flowing water for navigation purposes in an artificial waterway may indirectly injure the property rights of States or individuals, in water powers, drainage, sanitation, or consumption for domestic purposes. (See Report

[1] See Appendix C, p. 53.

of Subcommittee on Dams and Water Powers to Committee on Interstate and Foreign Commerce, House of Representatives, Sixtieth Cong., 2d sess., Feb. 25, 1909.)

51. It is impossible without a survey to even approximate the value of the rights in water referred to above, or to guess at the amount of claims which may be brought against the United States, for its use of the water supply required by a Lake Erie-Lake Michigan Canal, without an accurate topographical survey and gauging of streams.

52. While no effort has been made to collect commercial statistics, I have urged upon various individuals and associations interested in the proposed canal the desirability of collecting them for the use of the National Waterways Commission.

53. In a previous paragraph the statement is made that no estimate of cost of constructing a canal can be made even approximately without a survey. For the purposes of a survey the route may be divided into two parts, the first part being from Toledo to Fort Wayne, about 97 miles; the second, from Fort Wayne to Michigan City, about 118 miles. If the first part is to be surveyed in connection with the improvement of the Maumee River, as provided for in the river and harbor act approved June 25, 1910, it may be omitted from consideration, leaving the second part only to be surveyed for the specific purpose of canal construction. It is estimated that a survey party will consist of about 16 men, whose salaries and subsistence will cost about $60 per day, and that such a party will cover about 2 miles per day on the preliminary work and 1 mile per day on the location work; that is, 1 mile of completed work will cost about $40. It is estimated that it will cost about $20 per mile of canal to plot the field work and make completed drawings. The total cost per mile of survey will thus be about $60 per mile. The survey from Fort Wayne to Michigan City will cost about $7,080 and from Toledo to Michigan City about $12,900.

Very respectfully,

GEO. A. ZINN,
*Lieutenant Colonel, Corps of Engineers.*

# APPENDIX A.

[Extracts from the Prospectus of the Lake Erie & Ohio River Ship Canal Co.]

## BUSINESS FOR CANAL.

That there is sufficient present and prospective business for the canal and of such a character as to justify the investment is clearly shown as follows:

Sources of business:

1. Great Lakes—lake end of canal.
2. Pittsburgh district—river end of canal.
3. Ohio River.
4. Canal route between lake and river.

The following tables relating to commerce in above districts show that it has doubled every 6 to 10 years in the past and that the products of mines average 80 per cent of same.

1. Great Lakes—Total tonnage (Department of Commerce and Labor, United States):

| | Net tons. |
|---|---|
| 1904 | 51,370,855 |
| 1905 | 67,345,620 |
| 1906 | 75,610,690 |

Tonnage 1906 over 80 per cent ore and coal.

(*a*) "Soo" Canal, total tonnage passing (Department of Commerce and Labor, United States):

| | Tons. |
|---|---|
| 1881 | 1,567,774 |
| 1887 | 5,494,649 |
| 1893 | 10,796,572 |
| 1899 | 25,255,810 |
| 1905 | 44,720,680 |
| 1906 | 51,751,080 |

Of the above for 1906, 35,357,042 tons ore passed east, 7,728,255 tons soft coal passed west, 1,011,375 tons hard coal passed west; total, 44,096,672 tons—85 per cent.

(*b*) Detroit River, total tonnage passing (Department of Commerce and Labor, United States):

| | Tons. |
|---|---|
| 1905 | 53,639,086 |
| 1906 | 60,578,155 |

Of above for 1906, 32,208,009 tons ore passed south, 11,561,111 tons soft coal passed north, 2,960,920 tons hard coal passed north; total, 46,730,040 tons—77 per cent.

2. Pittsburgh district (river end of canal):

A thorough investigation of the canal committee of the Chamber of Commerce of Pittsburgh in 1896 estimated the river and rail ton-

nage in and out of the Pittsburgh district (a radius of 40 miles with Pittsburgh as center and not including freight in transit) at 60,000,000 tons.

The chamber of commerce estimate for 1906 in said district (not including freight in transit) is as follows:

| | Net tons. |
|---|---|
| Railway, 3,500,000 cars | 113,000,000 |
| Harbor | 9,000,000 |
| Total | 122,000,000 |

Of above for 1906:

| | Tons. |
|---|---|
| Coal | 48,400,000 |
| Coke | 20,160,000 |
| Ore to districts served by canal | 21,184,067 |
| Total | 89,744,067 |

Coal, coke, and ore, about 74 per cent of total tonnage.

3. Ohio River (Annual Report Chief of Engineers, U. S. Army):

| | Tons. |
|---|---|
| Upstream (1906) | 2,689,911 |
| Downstream (1906) | 10,473,745 |
| Total | 13,163,656 |

The volume of traffic on this river in its present intermittent state of navigation confirms the opinion that a great increase of traffic must result from the permanent navigable condition now being provided by the Government.

This increase will be further augmented by the union of this stream through the canal with the Great Lakes and tributary canals, making it possible for the commerce of the vast territory they serve to reach the mouth of the Mississippi River, and thence through the Panama Canal to Pacific coast, and through the Erie Canal to the Atlantic coast at New York.

(*a*) Monongahela River (Department of Commerce and Labor, United States):

| | Tons. |
|---|---|
| 1904 | 8,175,527 |
| 1905 | 10,993,133 |
| 1906 | 11,498,855 |

4. Along canal route, between lake and river:

This tonnage was estimated by the canal committee of Chamber of Commerce of Pittsburgh in 1896 to be 30,000,00 tons. It is estimated to have been not less than 60,000,000 tons for 1906, and about 78 per cent was ore, coke, and coal, as follows: Ore, 21,184,067 tons, lake to river and on canal route; coke, 9,000,000 tons, river to lake and on canal route; coal, 16,730,000 tons, river to lake; total, 46,914,067.

The above are the through shipments of coal from the Pittsburgh and West Virginia districts to the lake, and do not include coal shipped to manufacturers along line of canal. The coke is the tonnage west of Pittsburgh to furnaces located along the canal route and on Great Lakes, but this tonnage is not included in the estimated tonnage for canal, on which estimate of earnings is based.

The following Lake Erie ports receive the iron ore which goes by rail to furnaces along canal route and Pittsburgh district, on the Monongahela and upper Ohio Rivers, and through same ports the Lake Erie soft coal goes from Pittsburgh district, West Virginia, and Ohio to upper lake ports (Department of Commerce and Labor, United States):

| Ports. | Receipts, iron ore, 1906. | Shipments, soft coal, 1906. |
|---|---|---|
| | *Gross tons.* | *Net tons.* |
| Cleveland | 6,662,049 | 2,888,544 |
| Fairport | 1,832,623 | 276,328 |
| Ashtabula | 6,726,882 | 2,477,885 |
| Conneaut | 5,412,156 | 829,348 |
| Erie | 2,097,308 | 668,759 |
| Buffalo and Tonawanda | 4,915,308 | 412,911 |
| Lorain | 2,159,580 | 2,185,165 |
| Sandusky | 32,019 | 745,084 |
| Toledo | 1,438,396 | 2,314,247 |
| Huron | ..... | 771,375 |
| Total | 31,276,321 | 13,569,646 |

Of the ore coming down the Detroit River in 1906 to Lake Erie ports the following shows the amount forwarded from the docks to the furnaces in the districts named:

| | Tons. |
|---|---|
| Pittsburgh district | 11,230,000 |
| Mahoning and Shenango Valleys | 7,172,000 |
| Upper Ohio River (Wheeling district) | 2,841,000 |
| Lower Ohio River | 746,000 |
| Buffalo and east | 5,630,000 |
| Columbus, Ohio | 625,000 |
| Cleveland, Toledo, Lorain, and Detroit | 3,408,000 |
| Virginia | 72,000 |
| Total | 31,724,000 |

The first four districts, using 21,989,000 tons, would have water transportation through canal from Lake Erie to furnaces. District 5, which includes ore to Johnstown, Pa., amounting to 1,500,000 tons, would have water service from Lake Erie to Pittsburgh.

The following table shows soft coal loaded on vessels at following Lake Erie ports for transshipment and for vessel fuel for the year 1906 (Department of Commerce and Labor, United States):

| Lake Erie ports. | Transshipment. | Vessel fuel. | Total. |
|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* |
| Buffalo | 43,260 | 352,609 | 395,869 |
| Ashtabula | 2,256,813 | 256,054 | 2,512,867 |
| Cleveland | 2,604,769 | 451,769 | 3,056,538 |
| Conneaut | 666,475 | 176,251 | 842,726 |
| Erie | 564,788 | 128,541 | 693,329 |
| Fairport | 226,112 | 55,798 | 281,910 |
| Lorain | 1,605,832 | 203,266 | 1,809,098 |
| Sandusky | 669,294 | 112,510 | 781,804 |
| Toledo | 2,210,604 | 64,381 | 2,274,985 |
| Huron | 739,288 | 47,315 | 786,603 |
| Total | 11,587,235 | 1,848,494 | 13,435,729 |

The total lake tonnage of coal for transshipment and vessel fuel from Pittsburgh, West Virginia, and Ohio districts for the six years ending December, 1906, is as follows (John H. Jones, president Pittsburgh-Buffalo Co.):

| | Tons. |
|---|---|
| 1901 | 6,873,901 |
| 1902 | 8,703,258 |
| 1903 | 11,349,541 |
| 1904 | 9,893,000 |
| 1905 | 11,575,000 |
| 1906 | 14,510,000 |

District division comparing as follows:

| | 1904 | 1905 | 1906 |
|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* |
| Pittsburgh district | 6,058,000 | 7,460,000 | 9,200,000 |
| West Virginia | 1,966,000 | 2,108,000 | 2,750,000 |
| Ohio | 1,869,000 | 2,007,000 | 2,560,000 |
| Total | 9,893,000 | 11,575,000 | 14,510,000 |

The above authority states that from contracts already made for 1907 it is indicated that the coal tonnage from the Pittsburgh district in 1907 to the Lakes for transshipment and vessel fuel will approximate 11,000,000 tons.

The same operator states that the amount of coal going from above districts, all-rail haul, for direct consumption would equal 40 per cent of the coal for transshipment and vessel fuel, which makes the total coal movement in 1906 from the Pittsburgh and West Virginia districts to Lake Erie ports (for which canal would provide water service) as follows:

| | Tons. |
|---|---|
| Pittsburgh district | 12,880,000 |
| West Virginia | 3,850,000 |
| Total | 16,730,000 |

The ore tonnage coming from Lake Erie ports to furnaces that would be supplied with water transportation through the canal has increased from 8,000,000 tons in 1896 to over 21,000,000 tons in 1906, and the coal going to Lake Erie ports from the Pittsburgh district and West Virginia (also provided with water transportation by the canal) for consumption at said ports, vessel fuel, and transshipment to upper lake ports has increased from 6,000,000 tons in 1901 to over 16,500,000 tons in 1906, showing an average annual increase in ore of over 1,300,000 tons and an average annual increase in coal of about 2,000,000 tons, or a combined annual increase of over 3,000,000 tons.

*Estimated tonnage for district and canal.*—The above tables show over 38,000,000 tons of coal and ore as passing between these points in 1906, and assuming the canal to be begun in 1908, and completed in five years, the following table will show the probable tonnage available in coal and ore at time canal is opened for business, in comparison with amount of estimated canal tonnage for 10 years following its opening, on the basis of a conservative average annual increase of only 2,000,000 tons of coal and ore.

| Years. | Coal and ore tonnage. | Estimated tonnage for canal balance sheet. |
|---|---|---|
| 1906 | 38,000,000 | |
| 1907 | 40,000,000 | |
| 1908 | 42,000,000 | |
| 1909 | 44,000,000 | |
| 1910 | 46,000,000 | |
| 1911 | 48,000,000 | |
| 1912 | 50,000,000 | |
| 1913 | 52,000,000 | [1] 3,000,000 |
| 1914 | 54,000,000 | [1] 5,500,000 |
| 1915 | 56,000,000 | [1] 10,500,000 |
| 1916 | 58,000,000 | [1] 16,500,000 |
| 1917 | 60,000,000 | [1] 22,500,000 |
| 1918 | 62,000,000 | [1] 26,500,000 |
| 1919 | 64,000,000 | [1] 30,000,000 |
| 1920 | 66,000,000 | [1] 33,000,000 |
| 1921 | 68,000,000 | [1] 36,000,000 |
| 1922 | 70,000,000 | [1] 38,000,000 |

[1] Canal opens.

An analysis of the movement of coal and ore as given in foregoing tables shows that the ore shipped by rail from Lake Erie to furnaces in the districts at the river end of canal and the coal shipped from said districts by rail to Lake Erie furnishes nearly 50 per cent of the total tonnage passing through the Detroit River.

A further index of the volume of traffic in the canal district for 1906 is shown by the reports of the car-service associations. The number of cars handled in their respective territories is as follows:

| | Cars. |
|---|---|
| Pittsburgh | 3,295,463 |
| Illinois and Iowa | 3,085,315 |
| Chicago | 2,251,763 |
| Philadelphia | 2,218,755 |
| Terminal (Minneapolis) | 1,712,345 |
| Missouri Valley | 1,665,882 |
| New England | 1,974,894 |
| New York and New Jersey | 1,100,967 |

Product of mines explains large business of Pittsburgh district and indicates why water transportation is demanded.

### COMMERCIAL ECONOMY OF CANAL

This canal, as per transportation statement, can handle tonnage by the barge system between the steel plants and coal fields of the Pittsburgh district and Lake Erie, an average distance of 140 miles, at not exceeding following cost figures, including transfer of coal at lake, transfer of ore at lake, and from canal vessel to stock pile at furnace (see statement as to methods and cost of carrying freight in steamers or barge fleets, on p. 28):

| | Cost per ton. | Cost per ton-mile. |
|---|---|---|
| | *Cents.* | *Mills.* |
| Ore: | | |
| Operation and maintenance transfer (lake) | 4.0 | 0.29 |
| Operation and maintenance vessel | 8.1 | .58 |
| Operation and maintenance canal | 8.0 | .57 |
| Operation and maintenance transfer (furnace) | 4.0 | .29 |
| Total | 24.1 | 1.73 |
| Coal: | | |
| Operation and maintenance transfer (lake) | 4.0 | .29 |
| Operation and maintenance vessel | 8.1 | .58 |
| Operation and maintenance canal | 8.0 | .57 |
| Total | 20.1 | 1.44 |

| Cost per ton-mile: | Mills. |
|---|---|
| Average coal and ore, including transfers | 1.58 |
| Coal f. o. b. canal vessel at lake | 1.15 |
| Combined systems, per transportation statement, all freight | 1.12 |

The following shows the proposed charges:

| | Rate per ton. | Rate per ton-mile. |
|---|---|---|
| Ore: | *Cents.* | *Mills.* |
| Transfer at lake | 6.0 | 0.43 |
| Vessel rate | 13.2 | .94 |
| Canal tolls | 35.0 | 2.50 |
| Transfer to stock pile | 6.0 | .43 |
| Total | 60.2 | 4.30 |
| Coal: | | |
| Vessel rate | 13.2 | .94 |
| Canal tolls | 30.0 | 2.14 |
| Transfer at lake | 6.0 | .43 |
| Total | 49.2 | 3.51 |

| Cost per ton-mile: | Mills. |
|---|---|
| Average coal and ore, including transfers | 3.90 |
| Coal f. o. b. canal vessel at lake | 3.08 |
| Combined systems, per transporation statement, all freight | 4.10 |

## RAIL CHARGES.

The charge on ore from vessel to dock and dock to car is 20 cents per ton, and rail rate to Pittsburgh district (average 140 miles), including switching and labor to stock pile at furnace, is $1.14 per ton.

The system of rebates or premiums allowed consignees by the dock companies results in an average allowance of 9 cents per ton on a season's ore business, taking into consideration premium for direct ore as well as the arbitrary rebate allowed on dock shipments.

The rail rate on coal from Pittsburgh district to Lake Erie is 88 cents per ton, and dock charge 9 cents per ton for transfer to lake vessel bottom. The rail rate on coal as above for consumption at Lake Erie ports f. o. b. cars is $1 per ton.

The following will show, therefore, present rail rate, transfer at lake, switching and labor at furnace, and ton-mile rate on ore from lake vessel bottom to stock pile at furnace in Pittsburgh district, and rail rate and transfer of coal from mines in said district to lake steamer bottom, and ton-mile rate, in comparison with estimated canal charges for same service on an average distance of 140 miles:

| | Per ton. | Rate per ton-mile. |
|---|---|---|
| Ore: | | *Mills.* |
| Dock charges | $0.20 | ..... |
| Rail rate | 1.14 | ..... |
| Total | 1.34 | ..... |
| Less average rebate | .09 | ..... |
| Net charges by rail | 1.25 | 8.93 |
| Coal: | | |
| Rail rate | .88 | ..... |
| Dock charges | .09 | ..... |
| Total | .97 | 6.93 |
| Coal f. o. b. cars lake ports | ..... | 7.14 |

*Canal and rail rates compared.*

| | Canal cost, ton-mile. | Canal rate, ton-mile. | Rail rate, ton-mile. |
|---|---|---|---|
| | *Mills.* | *Mills.* | *Mills.* |
| Ore (lake vessel bottom to furnace stock pile) | 1.73 | 4.30 | 8.93 |
| Coal (mine to lake vessel bottom) | 1.44 | 3.51 | 6.93 |
| Coal (f. o. b. canal vessel at lake) | 1.15 | 3.08 | 7.14 |
| Coal and ore with transfers (average) | 1.58 | 3.90 | 7.98 |

As to cost figures for railroads, that of the Bessemer & Lake Erie is by far the lowest, inasmuch as this road is owned and operated as a department of the United States Steel Coroporation between Pittsburgh and Lake Erie, and publishes the same tariff rate on coal and ore as other lines, equaling 8.93 mills per ton-mile on ore from lake steamer bottom to stock pile at furnace, and 6.93 mills per ton mile on coal from mine to lake steamer bottom.

By their department report of operation, however, for the year ending December 31, 1906, they show cost of operation and maintenance equal to a ton-mile cost of freight moved of 2.08 mills per ton-mile and a rate of 4.38 mills per ton-mile. The cost and rate above given cover only the actual main line from f. o. b. cars at lake to Union Railway terminal at Pittsburgh. Adding the net dock charges on a season's ore business, 11 cents, and 5 cents to cover switching and labor by Union Railroad, or total 16 cents per ton, would make the average rate by this line on ore from lake vessel bottom to stock pile at furnace, and coal from mine to lake vessel bottom, 5.53 mills per ton-mile. Assuming 10 cents per ton to be the cost of dock and switching service, the total cost per ton-mile on ore and coal as above by this road would be 2.80 mills per ton-mile.

In this estimate of cost is considered the interest on capital investment in trackage and land necessary to handle ore at furnaces by rail, which requirement would be unnecessary or materially reduced in handling ore by water.

The greater economy of transfer of ore and coal via canal over rail is apparent in that the low cost of canal barges to carrying capacity will permit of their being kept in sufficient number at lake loaded with coal or empty for ore to eliminate the necessity for dockage of either commodity, and the expense incident thereto, but will permit direct transfer at all times.

Conditions favor a low cost and rate on the Bessemer & Lake Erie Railroad in comparison with other lines. Being a mineral railroad with through freight, its tracks are not encumbered with a large business in general merchandise, local freight, or passenger business requiring movement of trains on its tracks at different speeds, which increases operating cost for roads doing a general freight and passenger business.

The following will show comparison between the ship canal and the department rate of the Bessemer & Lake Erie Railroad as to average cost and rate in handling ore from lake vessel bottom to stock pile at furnace, and coal mine to lake vessel bottom:

| | Cost per ton-mile. | Rate per ton-mile. |
|---|---|---|
| | *Mills.* | *Mills.* |
| Ship canal | 1.58 | 3.90 |
| Bessemer & Lake Erie R. R. | 2.80 | [1] 5.53 |

[1] Published rate equals ore 8.93 mills, coal 9.63 mills for same service.

The freight carried by this road is largely ore for the furnaces of said Steel Corporation at Pittsburgh, and return cargo of coal for transshipment, and the statement of operation mainly applies to the movement of these commodities.

### CANAL PROFITS.

The sample balance sheet of the canal estimates the net profits will reach 6 per cent on the capital stock before the fifth year of operation, indicating that following the fifth year of operation, the average toll rates (32.5 cents per ton) can begin to be reduced as the tonnage increases in following years.

On the tenth year of operation the average toll rates could be reduced to 18 cents per ton, thereby reducing the average ton-mile rate on coal and ore, including necessary transfers, to 2.86 mills per ton-mile (as compared with Bessemer & Lake Erie Railroad present cost figures of 2.80 mills exclusive of fixed charges) and the canal still pay over 6 per cent on its capital stock.

### SAMPLE BALANCE SHEET OF THE LAKE ERIE & OHIO RIVER SHIP CANAL CO.

Following the statement of charter rights as to issue of bonds and stock, the canal company's sample balance sheet shows a period of five years for construction, assumed by the engineers to be ample time, with good management, especially when considering that supplies of all descriptions may be easily procured from nearby points. The amount of money needed to the end of the fifth year for actual construction, including interest on bonds and taxes, is $53,061,339. It will be observed that the canal in the third year of operation is self-sustaining, and between the fourth and fifth years pays a dividend on the capital stock of 6 per cent.

### TRANSPORTATION.

*Methods and cost.*—The volume of business expected to pass through the canal during the first 10 years of operation is set forth on the averaged statement, page 30.

This freight tonnage will likely be carried in either one or all of the four following manners:

1. By lake steamers of 2,000 tons maximum capacity, without breaking bulk from any of the lake ports, through the canal to the rivers about Pittsburgh, these steamers carrying miscellaneous freight, or iron ore and coal.

2. In boats of barge type of about 2,000 tons capacity, under their own power, from Lake Erie ports, where transfer cargo is received, through canal to rivers.

3. In boats of canal-lake barge type of approximately 2,200 tons capacity, in towed fleets, from lake ports through canal to the rivers.

4. In towed canal-barge fleets, each barge having a unit capacity of 1,200 tons, from the canal Lake Erie port, where transfer cargo is received, through canal to the rivers.

The fourth or canal-barge fleet system is best suited to conditions obtaining on the connecting rivers, as it permits the business to be

*Sample balance sheet—Construction, operation, and financial statement.*

## THE LAKE ERIE & OHIO RIVER SHIP CANAL CO.

[Authorized capital, national charter, $400,000 bonds. $400,000 stock per mile canal and branches. Main canal, 103 miles. Branch canals, 32 miles. Authorized capital, State charters, no limit to amount of capital or class of securities issued.]

| | Years construction. | Years operation. | Construction cost. | | | | | Tonnage and lockage. | | | | | Water requirements and supply. | | | | | | | | | | | | | | Gross expenses. | | | | | | | | | | Gross earnings. | | | | | Net earnings. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Bond sale. | | Stock sale. | | | | Vessels per day. | | | | Water required. | | | | | Watershed. | | | | Available water supply. | Maintenance and operation. | | Bond interest. | | Tax on stock. | | Total needed during construction. | Sinking fund. | Total disbursements. | | | Toll earnings (average, 32.5 cents per ton). | Interest on sinking fund (4 per cent). | Earnings from sale of surplus stock. | Total earnings. | | | | | | | | |
| | | | Per year. | Total sale. | Per year. | Total sale. | Total bonds and stock. | Estimated tonnage. | Steamer, 1,500 tons. | Barge fleet, 3,000 tons. | Lockages per day. | | Total. | By percentage. | | | | Name. | Area. | Annual minimum precipitation. | Depth needed. | | Per year. | Per ton-mile. | Per year (5 per cent). | Total. | Per year. | Per year on surplus. | | | Per year. | Per ton-mile. | | | | | Per year. | Per ton-mile. | Per year. | Per ton-mile. | Total. | Years operation. | Years construction. |
| | | | | | | | | | | | | | | Lockage.[1] | Evaporation and absorption. | Seepage. | Leakage, operating locks, electric lighting, spillways. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | *Cubic feet.* | | | | | | *Sq. mi.* | *Inches.* | *Inches.* | *Cubic feet.* | | *Mills.* | | | | | | | | | *Mills.* | | | | | *Mills.* | | | | | |
| Period of construction.... | 1 | .... | $2,060,000 | | $440,000 | | $2,500,000 | | | | | | | | | | | | | | | | | | | | | $2,500,000 | | | | | | | | | | | | | | | | 1 |
| | 2 | .... | 6,180,000 | $8,240,000 | 1,423,000 | $1,865,200 | 10,105,200 | | | | | | | | | | | | | | | | | | $103,000 | | $2,200 | | 10,105,200 | | | | | | | | | | | | | | | | 2 |
| | 3 | .... | 10,300,000 | 18,540,000 | 2,612,000 | 4,486,526 | 23,026,526 | | | | | | | | | | | | | | | | | | 412,000 | $515,000 | 9,326 | | 23,026,526 | | | | | | | | | | | | | | | | 3 |
| | 4 | .... | 12,360,000 | 30,900,000 | 3,567,000 | 8,075,959 | 38,975,959 | | | | | | | | | | | | | | | | | | 927,000 | 1,442,000 | 22,433 | | 38,975,959 | | | | | | | | | | | | | | | | 4 |
| | 5 | .... | 10,300,000 | 41,200,000 | 3,745,000 | 11,861,339 | 53,061,339 | | | | | | | | | | | | | | | | | | 1,545,000 | 2,987,000 | 40,380 | | 53,061,339 | | | | | | | | | | | | | | | | 5 |
| Period of operation. | 6 | 1 | | | | | | 3,000,000 | 1 | 3 | 4 | 10,758,205,000 | 9.4 | 44.9 | 33.1 | 12.6 | French, Cussewago, Pymatuning, Mill, Summit, Mosquito, Mahoning, and Cuyahoga. | 1,785 | 31 | 2.59 | 21,536,944,000 | $1,100,000 | 2.62 | 2,060,000 | | 59,307 | | | | $3,219,307 | 7.67 | $975,000 | | $2,244,307 | $3,219,307 | 7.67 | | | | | | 1 | 6 |
| | 7 | 2 | | | | | | 5,500,000 | 2 | 6 | 8 | 11,773,485,000 | 17.2 | 41.0 | 30.3 | 11.5 | ....do | 1,785 | 31 | 2.84 | 21,536,944,000 | 1,135,500 | 1.47 | 2,060,000 | | 59,307 | $11,222 | | | 3,266,029 | 4.24 | 1,787,500 | | 1,478,529 | 3,266,029 | 4.24 | | | | | | 2 | 7 |
| | 8 | 3 | | | | | | 10,500,000 | 3 | 12 | 15 | 13,611,965,000 | 28.4 | 35.5 | 26.2 | 9.9 | ....do | 1,785 | 31 | 3.28 | 21,536,944,000 | 1,206,000 | .82 | 2,060,000 | | 59,307 | 18,615 | | | 3,343,922 | 2.27 | 3,412,500 | | | 3,412,500 | 2.32 | $68,578 | 0.05 | $68,578 | 3 | 8 |
| | 9 | 4 | | | | | | 16,500,000 | 5 | 19 | 24 | 15,916,925,000 | 38.7 | 30.3 | 22.4 | 8.6 | ....do | 1,785 | 31 | 3.84 | 21,536,944,000 | 1,291,500 | .56 | 2,060,000 | | 206,000 | | | $447,800 | 4,003,300 | 1.73 | 5,362,500 | | | 5,362,500 | 2.32 | 1,357,200 | .59 | 1,425,778 | 4 | 9 |
| | 10 | 5 | | | | | | 22,500,000 | 7 | 25 | 32 | 17,947,485,000 | 45.7 | 26.9 | 19.9 | 7.5 | ....do | 1,785 | 31 | 4.33 | 21,536,944,000 | 1,377,000 | .44 | 2,060,000 | | 206,000 | | | 447,800 | 4,090,800 | 1.30 | 7,312,500 | $18,091 | | 7,330,591 | 2.33 | 3,239,791 | 1.03 | 4,665,569 | 5 | 10 |
| | 11 | 6 | | | | | | 26,500,000 | 8 | 30 | 38 | 19,511,565,000 | 50.0 | 24.8 | 18.3 | 6.9 | ....do | 1,785 | 31 | 4.70 | 21,536,944,000 | 1,434,000 | .39 | 2,060,000 | | 206,000 | | | 447,800 | 4,147,800 | 1.12 | 8,612,500 | 36,913 | | 8,649,413 | 2.33 | 1,501,613 | 1.21 | 9,167,182 | 6 | 11 |
| | 12 | 7 | | | | | | 30,000,000 | 9 | 34 | 43 | 20,801,245,000 | 53.2 | 23.2 | 17.1 | 6.5 | ....do | 1,785 | 31 | 5.02 | 21,536,944,000 | 1,484,000 | .35 | 2,060,000 | | 206,000 | | | 447,800 | 4,197,800 | 1.00 | 9,750,000 | 55,765 | | 9,805,765 | 2.33 | 5,607,965 | 1.33 | 14,775,147 | [2]7 | 12 |
| | 13 | 8 | | | | | | 33,000,000 | 10 | 37 | 47 | 22,245,968,000 | 54.2 | 21.9 | 17.8 | 6.1 | French, Cussewago, Pymatuning, Mill, Summit, Mosquito, Mahoning, Cuyahoga, Oil,[2] and Sugar. | 2,240 | 31 | 4.27 | 27,210,808,000 | 1,527,000 | .33 | 2,060,000 | | 206,000 | | | 447,800 | 6,240,800 | 1.35 | 10,725,000 | 74,617 | | 10,799,617 | 2.34 | 4,558,817 | .99 | 19,333,964 | 8 | 13 |
| | 14 | 9 | | | | | | 36,000,000 | 11 | 41 | 52 | 23,535,648,000 | 56.8 | 20.7 | 16.8 | 5.7 | ....do | 2,240 | 31 | 4.52 | 27,210,808,000 | 1,570,000 | .31 | 2,060,000 | | 206,000 | | | 447,800 | 4,283,800 | .85 | 11,700,000 | 93,470 | | 11,793,470 | 2.34 | 7,509,670 | 1.49 | 26,843,634 | 9 | 14 |
| | 15 | 10 | | | | | | 38,000,000 | 11 | 43 | 54 | 24,084,448,000 | 57.7 | 20.2 | 16.5 | 5.6 | ....do | 2,240 | 31 | 4.64 | 27,210,808,000 | 1,600,000 | .30 | 2,060,000 | | 206,000 | | | 447,800 | 4,313,800 | .82 | 12,350,000 | 112,323 | | 12,462,323 | 2.34 | 8,148,523 | 1.53 | 34,992,157 | 10 | 15 |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 |

[1] Lock chambers, 400 by 56 feet and 280 by 56 feet.

[2] Additional feeder necessary, cost $2,000,000, paid for from earnings.

NOTE.—To make calculations conservative, length of navigation season (221 days) and tonnage capacity of vessels have been assumed at their minimum.

handled with greatest efficiency, separate barge loads being thereby best distributed to the various furnaces along the rivers, and coal fleets conveniently collected from the tipples; next in value comes the third system, then the second, and finally the first.

The transfer cost of cargo at Lake Erie ports with modern loading and unloading appliances is relatively so small that the barge system is considered the most economical, both as to cost and time.

In arriving at this conclusion, it has been considered that although the furnaces may prefer large cargoes of ore, the coal mines can be better served by the smaller capacity barges, permitting the barges, when emptied of iron ore, to be quickly distributed to the various coal tipples for loading there, the towboat readily gathering up same, forming them into fleets. Also, the new Government locks built on the Monongahela River are arranged for fleets to be taken through at one lockage of the size here proposed, namely, one towboat and three barges, and it has been assumed that the unit fleet carries 3,600 tons. As some of the barges may be towed by cargo-carrying towboats, the assumption is that the full capacity of the fleet will reach 4,600 tons.

For convenience in calculation in making up the sample transportation statement, it has been estimated that 90 per cent of the total canal tonnage, composed of iron ore and coal, will be conveyed by towed canal-barge fleets, the remaining amount of the tonnage to be carried by steamers, a portion of them also moving ore and coal and the rest miscellaneous, or package freight. The average cost of moving the tonnage as above by the combined systems, including profit to the vessels, has been estimated not to exceed 1.2 mills per ton-mile.

Vessels coming through canal to the rivers will have a saving in fuel cost of over 50 cents per ton, which has not been considered in estimating operating costs.

The maximum draft for boats will be 11 feet.

For the purpose of calculation for the transportation statement, the following dimensions, tonnage capacity, and costs of boats have been ascertained.

*Number of vessels necessary to carry tonnage, vessel maintenance cost, and rate of transportation by combined system of canal-barge fleets and lake-canal steamers.*

| Years of canal operation. | Estimated canal tonnage. | Number barge fleets (per year). | Number steamers (per year). | Total number fleets and steamers (per year). | Number lockages (per day). | Time available per lockage (minutes). | Maintenance and operation. | | Total cost, including 15 per cent on investment— | | Canal toll. | Transfer cost. | Rate per ton-trip. | Rate per ton-mile. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Per ton-trip. | Per ton-mile. | Per ton-trip. | Per ton-mile. | | | | |
| | | | | | | | *Cents.* | *Mills.* | *Cents.* | *Mills.* | *Cents.* | *Cents.* | *Cents.* | *Mills.* |
| 1 | 3,000,000 | 7 | 6 | 13 | 4 | 360 | 9.5 | 0.68 | 15.7 | 1.12 | 32.5 | 9.25 | 57.45 | 4.1 |
| 2 | 5,500,000 | 13 | 11 | 24 | 8 | 180 | | | | | | | | |
| 3 | 10,500,000 | 24 | 22 | 46 | 15 | 96 | | | | | | | | |
| 4 | 16,500,000 | 38 | 34 | 72 | 24 | 60 | | | | | | | | |
| 5 | 22,500,000 | 52 | 46 | 98 | 32 | 45 | | | | | | | | |
| 6 | 26,500,000 | 61 | 54 | 115 | 38 | 38 | | | | | | | | |
| 7 | 30,000,000 | 70 | 62 | 132 | 43 | 33 | | | | | | | | |
| 8 | 33,000,000 | 76 | 68 | 144 | 47 | 31 | | | | | | | | |
| 9 | 36,000,000 | 83 | 74 | 157 | 52 | 28 | | | | | | | | |
| 10 | 38,000,000 | 88 | 78 | 166 | 54 | 27 | | | | | | | | |

NOTE.—The cost and rate figures will decrease slightly with increase of tonnage.

A steamer for lake and canal, 250 by 40 feet, holding about 1,700 tons, if constructed for carrying ore and coal only, will cost about $105,000; if fitted up as a package freight and passenger steamer, approximately $140,000.

A steel canal barge, 180 by 26 feet, of 1,200 tons capacity, will cost approximately $14,000; and a twin-screw towboat built for light draft, strong enough for lake use if desired, and to handle 3 barges, will cost about $60,000.

The canal, physically, will be modern in every respect, and navigation, with good management, can be operated in as businesslike manner as trains over a railroad. Waterways in some parts of the world are now demonstrating this fact. With rapid handling facilities at the canal terminal points, towboats with barge fleets, making full allowance for detention at terminals, locks, etc., can make a round trip in 4.2 days, moving 7,200 tons. The average speed through actual canal and rivers, including stops, reduction of speed in meeting vessels and at curves, but not detentions at terminals, for the entire distance from the river commercial center on the Monongahela to Lake Erie, 140 miles, will be approximately 3.25 miles per hour. The maximum speed in actual canal channel, 4 miles per hour; on rivers, 5 miles per hour. The maximum speed on the Ohio and Monogahela Rivers was averaged for up and down movement at 5 miles per hour.

The lake season has been gradually increasing for the past 20 years. For the last 5 years the average is 240 days. To be conservative, it is considered that boats will be actively engaged for an average period of 221 days annually, making due allowance for various time losses. According to this, one barge fleet, making 54 round canal trips, will carry per season 388,000 tons, which amount is considerably greater than averaged on the Lakes, even when considering the large ore and coal carrying vessels hauling between the ore region and Lake Erie ports.

The steamer traveling, say between Pittsburgh and Duluth, canal and Lakes, 2,040 miles, can make the round trip in 13½ days, moving 3,400 tons (the average used in the tabulated statements is 3,000 tons). It can make 16 round trips during the season, transporting 54,400 tons. The steamer round-trip sailing time now on the Lakes between Duluth and Ashtabula, 880 miles, is about 7 days, and 3 days are spent in port.

In the computation of cost of transport is included an equipment of vessels supposed to be held as a reserve to those in active service, approximately as follows: Barges 1 to 2, towboats 1 to 6, steamers 1 to 12.

The operating expenses, including profit, for a barge fleet is 0.94 mill per ton-mile, and is based partially upon similar fleets now working on the Monongahela River, but adjusted to the various controlling conditions in making the trip of 140 miles between river and lake.

The average operating cost for the ore, coal, and package freight steamers, including profit, is 2.64 mills per ton-mile, largely based upon the experience of similar vessels now navigating the Lakes. Proper allowance is made for lock stops, detentions, etc., peculiar to canal and rivers.

PHYSICAL FEATURES.

A glance at the map will reveal the fact that the shortest possible route to be found to connect the Ohio River with the Great Lakes is the belt of country through which extends the survey made by the Lake Erie & Ohio River Ship Canal Co. Of the 103 miles distance, not less than 49 per cent will be formed by canalized rivers, which nature has placed on the direct line to Lake Erie. The divide between the Ohio River and Lake Erie Basins is crossed at an elevation of 915 feet above sea, the lowest point to be found east of the State of Indiana, in which vicinity a canal to connect river and lake would have a length of about 250 miles, with the distance rapidly increasing in moving westward. It is thus possible to obtain by a cutting of not great depth or length, largely through glacial drift, a water surface elevation for the summit level 900 feet above sea, 116 feet lower than the summit found by the Pennsylvania Canal Commission, reducing the total lockage 232 feet. The available water supply area of the nearby sheds is very largely increased, as is the storage capacity.

The first division of the canal is formed by the Beaver River, length 20.5 miles. The second division is formed by the lower portion of the Mahoning, length 30 miles. The total rise for these divisions is 177 feet, requiring 12 locks to lift from the Government pool in the Ohio, whose surface is 668 feet above mean tide.

The Beaver River has an average surface width about three times that proposed for the canal. From the head of this stream a branch canal, by canalization of the Shenango River, is proposed 25 miles long, reaching to the steel centers of New Castle and Sharon.

Another proposed branch, 7 miles long, is from Niles, Ohio, to Warren, Ohio. Ten miles below Niles, Ohio, is the city of Youngstown, prominent as a steel center, with the works scattered along the river banks for a distance of some miles. At Niles, which is also a producer of steel products, begins the actual canal, with its general direction due north to Lake Erie. In the approach along Mosquito Creek Valley to the summit there is a rise of 55 feet requiring 3 locks. In the valley just mentioned, on the southern end of the summit, the topography being favorable, a lake is proposed 9.5 miles long. It forms about 30 per cent of the summit length. Due to its large capacity the advantages are that it can act for short periods somewhat as an auxiliary reservoir to the levels below, will permit boats navigating and passing at high speed, and provide for them at all times an excellent place of harborage. The summit is 31 miles long and terminates 13 miles south of Lake Erie. On the descent of the lake escarpment, to the mouth of Indian Creek, Lake Erie, elevation 573 feet above mean tide, 15 locks must be provided with a total drop of 327 feet, which fall is the same as made with 25 locks on the Welland Canal between Lakes Erie and Ontario. The total lockage, up and down between river and lake, is 559 feet.

*Alternate route.*—There is an alternate route from the Mahoning River to Lake Erie, diverging from the present one at Niles, keeping the river to a point above Warren, and then passing by a deep cut to the east slope of Grand River Valley, with a water surface

in the actual canal on the same level as that in the Mahoning River, and extending this level to a point about 17 miles south of Lake Erie. The lake terminal would be the same as for the Mosquito Creek route. Although this diversion would cost about $5,000,000 more than the other route, and would be 4 miles longer, the favorable features are that the summit could be 860 feet above tide, making 80 feet less lockage than the route via the Mosquito Creek, and 312 feet less than the one of the Pennsylvania Canal Commission. Also, the number of locks can be reduced by 5, and the water supply and reservoir capacity considerably increased.

*Water supply.*—On account of the phenomenal growth of tonnage in the canal and Great Lakes districts, constantly increasing each succeeding year in vast proportions, it has been considered necessary to provide in the estimates, at the start, for water sufficient to meet the demands of 38,000,000 tons annually passing the summit. This tonnage is expected at the end of the tenth year of operation. The main supply is to be taken to the north end of the summit from the east, and another supply to the south end from the west, thus insuring not only a ready supply to each approach, but an unbroken one at all times, being received by separate feeders. The region from which the main supply is to be taken, from strong flowing tributaries of the Allegheny River in Pennsylvania, is deeply covered with glacial drift and alluvium, in places to 100 feet or more, the mass of material being heavily charged with ground water as indicated by tests and by the streams during dry periods. At the source of many of the streams are to be found ponds and small lakes. In the upper basins the hills frequently attain heights of 1,700 feet and more above tide. The general rock floor slopes toward the canal, passing slightly under the bottom. Such, in general, is the character of the country from which will be drawn the main water supply.

The north feeder, broken into three parts by two reservoirs, to be on its direct line, will have a total length of 45.7 miles. The main reservoir will cover a glacial swamp, and have a capacity of 10,000,000,000 cubic feet. The south feeder of 34.5 miles length, starting from a reservoir, will receive water from tributaries of the Ohio River.

The total drainage area available to the summit level is nearly 6,000 square miles. The area considered necessary to draw upon to provide for a business of 38,000,000 tons annually is 2,240 square miles. The average total annual rainfall for this section is about 39 inches. The annual depth of rainfall available from this area, taken largely from the flood stages, is 5.2 inches, supplying 27,211,000,000 cubic feet. The amount actually needed is 24,084,400,000 cubic feet, from a depth of 4.6 inches. To properly control the water to be taken from the streams during high stages storage reservoirs are included in the project with an aggregate capacity of 72 per cent of the needed supply. The topography is so formed that considerably more can be impounded if found necessary as business increases.

The average season of navigation on the Great Lakes, basing upon 17 years, is 235 days. In computing for water supply, the season was made 245 days, to be conservative.

Table of annual rainfall at stations in this territory, compiled from United States Government and State reports, as follows:

*Precipitation on watersheds.*

| Stations. | Years. | Minimum. | Maximum. | Mean. |
|---|---|---|---|---|
| | | *Inches.* | *Inches.* | *Inches.* |
| Westfield, N. Y. | 8 | 31.75 | 44.90 | 36.46 |
| Volusia, N. Y. | 5 | 40.71 | 47.10 | 43.31 |
| Jamestown, N. Y. | 8 | 41.97 | 52.72 | 39.60 |
| Columbus, Pa. | 7 | 36.43 | 64.49 | 45.55 |
| Erie, Pa. | 31 | 28.36 | 55.20 | 39.88 |
| Saegerstown, Pa. | 13 | 31.97 | 52.20 | 44.66 |
| Greenville, Pa. | 4 | 28.43 | 36.99 | 39.56 |
| Franklin, Pa. | 29 | 31.70 | 59.80 | 43.51 |
| Oil City, Pa. | 23 | 22.80 | 50.62 | 42.06 |
| Warren, Pa. | 20 | 32.05 | 58.20 | 43.34 |
| Average | | 32.62 | 52.22 | 41.79 |
| Youngstown, Ohio | 10 | 27.17 | 36.84 | 32.50 |
| Warren, Ohio | 10 | 32.66 | 44.20 | 38.45 |
| Garrettsville, Ohio | 21 | 30.60 | 46.08 | 38.63 |
| Hiram, Ohio | 15 | 31.69 | 45.71 | 39.50 |
| Auburn, Ohio | 4 | 32.38 | 41.43 | 36.23 |
| Lordstown, Ohio | 10 | 27.65 | 43.27 | 34.98 |
| Hudson, Ohio | 26 | 30.90 | 55.00 | 40.08 |
| Akron, Ohio | 13 | 31.15 | 49.93 | 37.85 |
| Atwater, Ohio | 9 | 30.33 | 44.85 | 37.74 |
| New Waterford, Ohio | 10 | 33.98 | 49.60 | 42.66 |
| Millport, Ohio | 9 | 30.39 | 48.00 | 32.20 |
| Greenhill, Ohio | 12 | 28.77 | 47.80 | 37.59 |
| Canton, Ohio | 22 | 31.29 | 54.10 | 39.14 |
| New Berlin, Ohio | 11 | 24.09 | 45.73 | 34.47 |
| Average | | 30.22 | 46.61 | 37.29 |

*Estimate of cost.*—Most of the prominent canals of the world have been enlarged within recent years to meet the demands of expanding business in regions not to be compared with the conditions now obtaining or future possibilities in this section of the country. Provision is therefore made in the estimate, particularly for important parts, with the idea to obviate the necessity of enlargement for many years after construction.

The canal prism is to be as follows: In earth, width at water surface 177 feet, bottom 131.25 feet, depth 13 feet; in rock, width at water surface, 155 feet, bottom 153 feet, depth 13 feet. The channel bottom width on the Beaver River to be 175 feet, and in the Mahoning 150 feet, with a depth in each case not less than 13 feet.

The locks are to have a full chamber length of 400 feet, available length 360 feet, width 56 feet, and depth over sills of 12 feet, but so built that 15 feet may be easily obtained when desired. It is designed to have intermediate gates to use in locking through steamers and small craft.

The locks on the Ohio River now nearing completion have a length between quoins of 600 feet, width 110 feet, and depth over sills of 9 feet. The Monongahela River locks have a length and breadth same as adopted for this canal, but the depth over sills is 11 feet. That the Government will increase these depths at the proper time to conform to canal requirements there can be no doubt.

In estimating for cost of bridges, provision is made for a clearance between water surface and lowest member of bridge of 45 feet on river division and 40 feet on canal proper. An exception to this occurs with several unimportant branch railroads and one highway, where the bascule form of bridge is considered.

Regarding the harbor at entrance of canal to Lake Erie no cost is included, as the Government, following the policy employed for many years, will provide what is required beyond the water's edge. Inside the canal mouth estimates include a vertical-sided channel 300 feet wide, 22 feet water depth, and a length back from the Government lake harbor to the first lock of 3,000 feet. Along this reach and on side basins or slips the large lake vessels can be constantly engaged during the season delivering and receiving cargoes to and from the canal barges by the aid of rapid loading and unloading machines.

Right of way is averaged at 800 feet width for canal proper. For the Beaver River little land is necessary beyond sites for locks and landings. Along each bank of the Mahoning an average width of 150 feet is considered sufficient.

*Estimate of cost.*

(Beaver division, 20.5 miles.)

| | | |
|---|---|---|
| Excavation: | | |
| Earth, 6,180,000 cubic yards | $1,545,000 | |
| Rock, 874,000 cubic yards | 2,185,000 | |
| Bank protection | 34,000 | |
| Basins | 171,000 | |
| Locks (5) | 1,245,000 | |
| Dams | 303,000 | |
| Bridges: | | |
| Highway | 161,000 | |
| Railroad | 134,000 | |
| Right of way | 50,000 | |
| Damages | 880,000 | |
| | | $6,708,000 |

(Mahoning division, 30.3 miles.)

| | | |
|---|---|---|
| Excavation: | | |
| Earth, 11,580,000 cubic yards | 4,053,000 | |
| Rock, 193,000 cubic yards | 511,000 | |
| Bank protection | 507,000 | |
| Retaining walls | 552,000 | |
| Basins | 194,000 | |
| Locks (7) | 1,699,000 | |
| Dams | 233,000 | |
| Bridges: | | |
| Highway | 618,000 | |
| Railroad | 1,804,000 | |
| Right of way | 249,000 | |
| Damages | 900,000 | |
| | | 11,320,000 |

(Mosquito Creek, Summit, and Lake Erie divisions, canal proper, 52.6 miles.)

| | | |
|---|---|---|
| Excavation: | | |
| Earth, 17,100,000 cubic yards | 5,130,000 | |
| Rock, 3,810,000 cubic yards | 3,358,000 | |
| Bank protection | 775,000 | |
| Walls between locks | 33,000 | |
| By-passes | 60,000 | |
| Culverts | 70,000 | |
| Spillways | 60,000 | |
| Locks (18 lift, 1 guard) | 4,610,000 | |
| Bridges: | | |
| Highway | 2,114,000 | |
| Railroad | 1,303,000 | |
| Mosquito Lake | 492,000 | |
| Right of way | 215,000 | |
| Damages | 500,000 | |
| | | 18,720,000 |

(Water supply.)

| | | |
|---|---|---|
| **Feeders:** | | |
| French Creek, 45.7 miles | $2,992,000 | |
| Mahoning, 34.5 miles | 981,000 | |
| **Reservoirs:** | | |
| Pymatuning, French Creek feeder | 1,543,000 | |
| Mill Creek, French Creek feeder | 230,000 | |
| Mahoning, Mahoning feeder | 970,000 | |
| | | $6,716,000 |
| Total | | 43,464,000 |
| Engineering and contingencies, 15 per cent | | 6,520,000 |
| Grand total | | 49,984,000 |

*Unit prices.*

| | |
|---|---|
| **Excavation, per cubic yard:** | |
| Earth— | |
| Dry canal proper | $0.30 |
| Dry Beaver River | .25 |
| Wet Mahoning River | .35 |
| Rock— | |
| Dry | .75 |
| Wet Beaver River | 2.50 |
| Wet Mahoning River | 2.65 |
| Lake end, partly submerged, averaged | 1.25 |
| Tunnel, earth | 5.00 |
| **Puddling, per cubic yard** | .85 |
| **Embankment, per cubic yard:** | |
| Earth fill— | |
| Reservoir dams | .35 |
| Reservoir road crossings, etc | .30 |
| Railroad, without interrupting traffic | .80 |
| **Bank protection, per cubic yard** | 3.00 |
| **Bridge, rivers and canal, per cubic yard:** | |
| Earth excavation— | |
| Dry | .30 to .40 |
| Wet | .55 |
| Earth approach— | |
| Highway, Beaver River | .50 |
| Highway, Mahoning River | .40 |
| Canal highway | .30 |
| Railroad, Beaver River | .80 |
| Railroad, Mahoning River | .65 |
| Concrete— | |
| Piers, railroad | 10.00 to 12.00 |
| Abutment | 7.00 |
| Highway | 6.00 to 10.00 |
| Feeder culvert | 6.00 |
| Superstructure— | |
| Railroad, double, linear foot | 100.00 to 135.00 |
| Railroad, single, linear foot | 56.00 to 80.00 |
| Highway, electric railroad, linear foot | 50.00 to 70.00 |
| Highway, linear foot | 40.00 to 56.00 |
| **Feeders:** | |
| Superstructure— | |
| Highway, linear foot | 30.00 to 45.00 |
| Railroad, linear foot | 60.00 |
| **Locks:** | |
| Concrete— | |
| Rivers, cubic yard | 6.50 |
| Canal, cubic yard | 6.00 |
| Gates, per square foot, averaged | 3.90 |
| Power plant, operating machinery | 10,500.00 |
| Power house | 3,400.00 |
| Tenders' house (2) | 4,000,00 |
| Lighting, fittings, etc. (6 lights per lock) | 1,500.00 |
| By-passes | 6,000.00 |

| | |
|---|---|
| Dams: | |
| Concrete, per cubic yard | $6.50 |
| Movable top, linear foot | 36.00 to 45.00 |
| Sheet piling, per M feet b. m | 55.00 |
| Round piling, linear foot | .30 |
| Right of way, per acre: | |
| Beaver River | 200.00 to 2,000.00 |
| Mahoning River | 150.00 to 3,000.00 |
| Canal proper | 50.00 |
| Feeders | 50.00 |
| Land, per acre: | |
| Mosquito Lake | 40.00 |
| Pymatuning Reservoir | 15.00 |
| Small reservoirs | 30.00 |

## APPENDIX B.

[Extracts from pamphlet entitled The Michigan & Erie Ship Canal.]

### THE PROPOSED MICHIGAN & ERIE CANAL AN INDISPENSABLE PART OF THE GREAT EAST-AND-WEST MAIN WATER ROUTE.

By Frank B. Taylor.

The great east-and-west trunk line or long-haul waterway from Chicago to the sea may be said to be composed of four divisions—(1) the Hudson River, (2) the Erie & Hudson Canal, (3) Lake Erie, and (4) either the lake route through Mackinac Straits, now in use, or else the proposed Michigan & Erie Canal, which would cut off the long northward detour and would run from Lake Erie to Chicago by a nearly direct route. This canal would shorten the distance about 400 miles and would make the long-haul, all-water route from Chicago to the seaboard of substantially the same length as the present all-rail route. To have a deep waterway or ship canal from Chicago to New York as short as the direct all-rail route is the best result that can be reached. No better solution of the Middle West-to-seaboard transportation problem is attainable. It represents the maximum possible efficiency of water transportation—the cheapest possible water rates for the unavoidable long haul. Water and rail transportation would then be set up against each other in flat competition, with no advantage of distance to either one. The only advantages either would have over the other would be such as are inherent in the instrument. Cars would be better for some things, boats for others; and equality of distances would tend to make the adaptation of trade to them more perfect and thus give the best possible service to the public.

When the Erie Canal in New York has been completed as a ship canal, the great east-and-west deep-water route as it has been thought of up to the present time will be finished and ready for use. But it will be far from perfect even then; for it will still be about 400 miles longer than the all-rail route, and water rates for transportation will therefore fail to touch the bottom values which ought to be reached.

This extra 400 miles is 43 miles farther than from Chicago to Cleveland by rail, nearly as far as from Baltimore to Boston, and lacks only 42 miles of being as far as from New York to Buffalo by the New York Central Railroad. This much distance would be saved every trip. Not until a shorter route is made available will east-and-west long-haul rates come down to bedrock value, which they ought to reach and which the people are entitled to have. Too much stress can not be laid upon the fact that even after the Erie Canal is completed every ship and barge that sails from Chicago to New York by way of the Straits of Mackinac will have to travel about 400 miles farther than it would if a deep waterway were built from Chicago

to Toledo across northern Indiana and Ohio. And, further, in going back to Chicago every returning ship will have to repeat the same 400 miles detour through the northern straits. In short, every boat plying between Chicago or any point west of Chicago and Toledo or any point east of Toledo will have to travel 800 miles farther than necessary in every round trip until the proposed Michigan & Erie Canal is built. This is 37 miles farther than from Fort Wayne to New York by the Pennsylvania Railroad, or exactly as far as from Chicago to Baltimore. This distance of 800 miles would be saved on every round trip. Indeed, every ship that travels the northern route to-day has to make this long detour, and every ship in the past has had to do it. The value of the coal alone that has been consumed in traveling this extra 400 miles is probably more than enough to build the canal, to say nothing of the insurance premiums and losses paid and the value of the lives and property lost in wrecks that would have been avoided.

Between Chicago and New York the saving of distance by the proposed canal amounts to two-sevenths or a little more than one-quarter of the whole distance; between Chicago and Buffalo it is nearly one-half; between Chicago and Cleveland or Detroit more than one-half, and between Chicago and Toledo nearly two-thirds. Can there be any doubt of the value of this canal if its construction is feasible and within bearable limits of expense?

The accompanying sketch map, figure 1, shows the place of the proposed canal as a link in the great east-and-west water route. Its advantages as a cut-off or short route from Chicago to Lake Erie will be easily noted, and also the fact that it makes a nearly straight line from Chicago to Troy, N. Y., and thus gives an all-water route to New York City, which is practically of the same length as the all-rail route—roughly, 1,000 miles, instead of 1,400 miles as the all-water route is now.

This canal is really an indispensable part of the east-and-west main water route to the sea and will surely be built sooner or later. Indeed, after the Erie Canal has been made into a ship canal it can not be long deferred. Its service to commerce will be like that of the Baltic Canal in Germany; like that of the proposed Sandwich Canal which will cut off Cape Cod, and like the proposed Florida Canal. It will cut off the southern peninsula of Michigan, save the long northward detour, and give a route which will be closed by ice only half as long.

### REASONS FOR SELECTING THE FORT WAYNE AND ROCHESTER ROUTE BETWEEN TOLEDO AND CHICAGO.

Lake Erie is 573 feet and Lake Michigan 581 feet above sea level. The lowest passage over the drift ridge between them is through the old outlet channel at Fort Wayne at 760 feet. Indians used this route before the coming of the white man, and the engineers of 1826 used it for the old Wabash & Erie Canal. But that canal was designed to connect Lake Erie with the Ohio and Mississippi Rivers. It was never built to Lake Michigan or to Chicago, although a line going northward from Delphi was surveyed in 1831. Many years ago a canal was talked of to connect Toledo and Michigan City by a nearly direct route. This was in 1880 or 1881—about the same time the

Wabash & Erie Canal was resurveyed by the late William S. Goshorn from Toledo to Lafayette for a projected enlargement which was never carried out. About 1895 Dr. William T. Harris, then of Defiance, Ohio, now of Chicago, began promoting the Toledo-Michigan City project. The route suggested by him was up the Maumee to the State line east of Fort Wayne, and thence west to Cherubusco through the valley of Cedar Creek, or else up to Fort Wayne and northwest from Fort Wayne to the same point, and thence past Goshen, Elkhart, and South Bend to Michigan City. As an alternative to this and affording a shorter route, a line was suggested leaving the Maumee at Defiance and going northwest over the high moraine to Pigeon Creek and down this to Elkhart, South Bend, and Michigan City. The summit level on the Cherubusco route could hardly be less than 850 feet above sea level, or 100 feet higher than the summit level available at Fort Wayne. On the Pigeon Creek route it would have to be 50 to 100 feet higher than on the Cherubusco line. Either of these routes is feasible for a small canal of the old type, but, as will be pointed out below, they are both impossible for a deep waterway or a ship canal.

At a meeting of citizens in the city of Fort Wayne November 16, 1907, called to start a movement for a canal from Toledo to Fort Wayne, a plan was suggested for a deep waterway or ship canal from Toledo to Chicago, passing through Fort Wayne and Rochester, Ind. The route proposed is as follows: From Toledo up the Maumee River to Fort Wayne; thence through the old outlet channel to Huntington, and along the higher ground on the north side of the Wabash River to the city of Wabash; thence northwestward in a nearly direct line, crossing Eel River a little below Roann, and continuing in the same line past Rochester and down the Tippecanoe River to a point south of Lake Maxinkuckee; thence on the same line across the Kankakee River at the lower end of English Lake, passing north of Kouts Station; thence from a point about 6 miles northwest of Kouts northward to a point 2 miles east of Sedley, and thence, as may seem best, either directly north to Lake Michigan at a point 8 miles northeast of Hobart, or continuing northwest from Sedley to Wolf Lake and South Chicago. On this route it is designed that the summit level shall run from Fort Wayne, or some point a few miles east of Fort Wayne, to a point on the Tippecanoe River south of Lake Maxinkuckee and that the canal in this interval shall be level and without locks. This would give a summit level about 100 miles long at an altitude somewhere near 750 feet above the sea, or 177 feet above Lake Erie. With locks of 20 feet lift, 16 or 18 locks would serve the whole canal.

The selection of this route is based on the following principles, which seem to be essential elements in the building of a deep waterway or ship canal under the conditions which exist in the region between Lake Erie and Lake Michigan.

(1) The canal must have the largest possible supply of water at its summit level—at least enough to operate one of its locks 100 times a day, and as much more as is possible. This is the first and indispensable requisite.

(2) The canal should have the lowest possible summit level in order (*a*) that the building of locks, which is very expensive, shall be reduced to a minimum in the original cost of construction, and (*b*) that

the number of locks shall be the fewest possible, because boats lose time in passing through them and because locks add materially to the cost of both operation and maintenance.

(3) The canal should follow the shortest line on which its construction is feasible and on which it can have at the same time the fewest locks and obtain the greatest possible water supply for its summit level.

A comparison of the Fort Wayne-Rochester route with any other that has been suggested, or that can be suggested, shows that this route would have a lower, longer summit level and hence fewer locks, and would secure a very much larger water supply for its summit than can be obtained on any other route. All the routes suggested appear to be feasible from the point of view of engineering. But in the matter of water supply at summit level, which, after feasibility of construction, is the all-important thing for a deep waterway or ship canal, the several routes are widely different. The Pigeon Creek and Cherubusco routes would have their summits on the top of the high drift ridge, where the possible water supply is necessarily limited. The summit level would have to be short—certainly not more than 15 or 20 miles long—on both of these lines, and the area of country which could by the utmost effort be made tributary to the summit level would be relatively small. On either of these routes the area could hardly exceed 700 or 800 square miles. There would be no rivers to draw upon and only a few very small creeks. Almost the entire reliance would have to be upon the existing lakes, of which there are a considerable number, and upon reservoirs artificially constructed. But these lakes and reservoirs would be not merely a supplementary supply to use in the dry months to augment temporarily a regular supply from other sources, as would be their use on the Fort Wayne-Rochester route; they would be the sole reliance and would have to be drawn upon throughout the whole season of canal navigation. The drainage areas available for the different summit levels are shown in the second map, figure 2. These routes are both excellent lines for canals of small size, say of 6 or 7 feet depth, and one or both of them will no doubt be utilized some time in this way. But they are manifestly not available for a great, deep waterway or ship canal.

If a deep waterway between Lake Erie and Lake Michigan is to serve the purpose for which it is intended, it must have water enough to operate its locks a great many times each day, for if it were in any sense a success, it would be a very busy canal. When this canal is planned officially, it ought to be with a distinct view to future possible needs; that is, it ought to be laid out on that route which will command or make available the maximum possible water supply for its summit level. It seems improbable that a 14-foot canal could have water enough at its summit level on either the Cherubusco or Pigeon Creek routes; but granting for the moment that it would, the developments of the near future will surely show the folly of such a choice. When the Erie Canal in New York is made into a ship canal, 21 or perhaps 24 feet deep, as it surely will be in the near future (the Chicago Drainage Canal is now a splendid ship canal, 24 feet deep and 162 feet wide in its rock sections), it will at once become desirable, if not imperative, not merely to have the proposed canal, but to have it of the same capacity as those east

and west of it. In that event it would be simply impossible to get water enough for a 21 or 24 foot canal on the Cherubusco or the Pigeon Creek routes.

Finally, when a canal has been brought from Toledo up to the summit at Fort Wayne, what is the use of running it up over a hill 100 feet higher than Fort Wayne, building 10 or 12 more locks than necessary, and causing every boat to lose the time required to operate them forever after? Why go over a hill when a way is open to go around it on a level line and with immense advantages for the summit-level water supply?

Two other routes have been suggested in times past. One is over the hill in southern Michigan, going up either the Raisin, or the Huron River to Jackson and then down either the Kalamazoo or Grand Rivers to Lake Michigan. These are feasible for small canals but are open to the same objections as the Pigeon Creek and Cherubusco routes—too high and not enough water supply. The Huron River is larger than the rivers on the other high level routes and the accessible lakes are larger and more numerous, but the summit level would have to be up to nearly 1,000 feet above the sea.

The other way is along the line of the old Wabash and Erie Canal from Fort Wayne down the Wabash River to Delphi, and thence north to Lake Michigan. But on this route the canal would descend to the Wabash River at Huntington and the summit level at Fort Wayne would be short, and would be fed only by the St. Joseph and St. Marys Rivers at Fort Wayne, with possibly the Wabash and Salamonie Rivers added at some point above Huntington. Of these streams the St. Joseph is the best, but is not large. The others are not so good as the St. Joseph. It is doubtful whether a 14-foot canal could be operated successfully from these streams in a dry autumn. But again, having brought the canal up to the Fort Wayne divide, what is the use of dropping it down into the Wabash Valley and losing the advantage of the large summit-level water supply, if it is possible to run the canal along on a level and secure this supply

## FEASIBILITY OF CONSTRUCTION ON THE PROPOSED ROUTE.

The physical features of the route may be briefly summarized as follows: Rock cutting would be necessary in slight measure in two and possibly three stretches of the canal, but there would be no deep cutting. For about 15 miles above Maumee, Ohio, the river has rapids over limestone ledges. Rock cutting here would be confined almost wholly to shallow cutting in the bed of the canal, an ascent of about 63 feet being made in this interval. Rock would be encountered again at Huntington, Ind., and more or less of it from there to Wabash. But here again little if any of the cutting would be deeper than the bed of the canal. There is also a possibility of encountering a little rock cutting near Kouts in the northwestern part of the State, but this would be short and shallow and might possibly be avoided altogether. None of these rock cuts are formidable from the point of view of canal construction, and it is doubtful whether all of them together will supply as much stone as will be needed for bank protection.

The only sections of the canal that present anything difficult in construction are two localities in which the most desirable route for

the canal would require rather deep cutting. Both of these, however, would be entirely in clay drift with no rock cutting whatever and the work is simply a straightaway problem for steam shovels. The most formidable cut would be through the big drift ridge between Roann and Rochester. Here for a distance of 5 or 6 miles the ridge has an altitude of about 850 feet, requiring a cut of about 100 feet deep through this part. For 6 or 8 miles more the cutting would be 50 feet or less in depth, about two-thirds of it less than 25 feet.

This is what would be required if the canal is built on the shortest possible route from Fort Wayne to Chicago. But it can be conducted around this hill, if desired, by a longer route so as to reduce the depth and length of the deep cut or even to avoid deep cutting entirely. This could be accomplished by turning west on the north side of Eel River. Near Denver, 6 miles west, the canal could be turned north so as to pass down the valley of Mud Creek to the Tippecanoe River. On this line the 100-foot cut would be reduced to a mile or two and most of the remainder would be under 50 feet. Or, going a little farther west, the canal could be turned northwest at Hoover to a point about 3 miles east of Lucerne and thence north. By this route there would be very little cutting more than 50 feet and most of it 25 feet or less. If this route proved too formidable, the canal could be carried still farther west to a point about 8 miles northwest of Logansport, where it could turn northward to the Tippecanoe without any deep cut whatever, the level of the land being nearly the same as that of the canal. As is often done in great works of this kind, the making of the direct-line deep cut might be deferred in the first construction, to be completed at a later time. These alternative routes make the summit level somewhat longer, but do not sacrifice the large water supply.

Next to this the most important cutting would be through the clay hill between Kouts and Sedley. This would be 7 or 8 miles long, but would be more than 50 feet deep only for a mile or two with a maximum of about 80 feet. Here again, however, if deemed necessary, the cutting can be entirely avoided by turning the canal west just north of Kouts to Hebron and thence north past Leroy and down Deep River. The divide in the valley which cuts the ridge at Leroy has an altitude of 686 feet, and the projected level of the canal through this section is 680 feet.

There would also be cutting in the drift 30 or 40 feet deep for perhaps 5 or 6 miles between Wabash and Roann and occasional short cuttings between Huntington and Wabash, but not of formidable depth.

The deep cuts required if the canal were built as projected on the shortest possible line would not be justified in the construction of a small canal, but they are entirely within the measure of surmountable difficulties and bearable and justifiable expense for a deep waterway or ship canal constructed by the National Government, or by the National Government and the local States combined; a canal serviceable chiefly as a highway of national commerce rather than for local purposes, and presenting possibilities of incalculable advantage for military purposes in times of war. It seems certain that the difficulties of construction along the projected line, including the deep cuts, are not such as would lead the National Government to deviate from the direct course laid out. Even if, as might seem best, the

canal be given a depth of only 14 feet at first, its course ought to be laid out with a view to possible future enlargement to a ship canal 21 or 24 feet deep, or equal to the deepest canal elsewhere connected with the Great Lakes. Its permanent works—its locks and terminal facilities in particular—ought to be built in the first place for a ship canal, and should therefore be of large size and so arranged as to be easily made double in the future at each locality. The prism of the canal (its depth and width) between the locks could readily be enlarged at a later time if found necessary. But the rebuilding and enlargement of locks would be troublesome and very expensive.

### THE LONG SUMMIT LEVEL AND THE LARGE WATER SUPPLY MADE AVAILABLE BY IT.

There are many advantages in the very long summit level proposed for this canal. Its length of 100 miles or more makes it possible to bring in more streams and a greater quantity of water at the summit than could possibly be obtained on any other summit level in the region traversed. The long summit level would touch or cross the St. Marys and St. Joseph Rivers at Fort Wayne, the Eel River below Roann, and the Tippecanoe River below Rochester. It would also pass within comparatively easy reach of the Yellow River near Lake Maxinkuckee and the Wabash and Salamonie Rivers near Huntington. At Mr. Leverett's request Mr. M. O. Leighton, chief of the hydrographic division of the United States Geological Survey, furnished the following official data on the quantity of water available for the summit level of the proposed canal from the first five rivers named.

*Michigan and Erie Canal via Fort Wayne and Rochester.*

Water supply required for 50 complete lockages (100 single lockages) per day for summit level, elevation 750 feet above sea level, length about 100 miles. (Depth of canal proposed to be 14 feet or deeper.)

| | Cubic feet. |
|---|---|
| Locks, 348 by 69 by 16 feet, water contents | 384,192 |
| 100 lockages per day, in round numbers | 38,400,000 |
| Add 10 per cent for leakage, in round numbers | 3,800,000 |
| Total | 42,200,000 |

Equivalent to 490 second feet (cubic feet per second).

| Drainage areas tributary to summit level: | Square miles. |
|---|---|
| Upper Eel River above Laketon | 480 |
| Tippecanoe River above Fulton-Pulaski County line | 760 |
| Yellow River above Marshall-Stark County line | 260 |
| Total | 1,500 |

These are the figures furnished by Mr. Leighton. But by placing the dam on Eel River at Roann a further area of about 100 square miles may be added to this figure for Eel River. This would make the total 1,600 square miles. Mr. Leighton states further that the mean flow for the lowest months in each year for four years at Delphi, Knox, and Logansport is 0.29 second-foot per square mile. This multiplied by 1,600 gives 464 second-feet. The mean flow for the lowest month of the St. Marys River at Fort Wayne is 40 second-feet. The mean flow for the lowest month of St. Joseph River at

Fort Wayne is 150 second-feet. This gives a total available low-water flow of 654 second-feet. Subtracting 490 second-feet, which is needed for 50 complete lockages per day, plus 10 per cent for leakage, there remains an excess of 164 second-feet without resorting to storage.

Such a showing as this from only the convenient streams and without any resort to storage or the bringing in of water from more distant rivers gives sure ground for faith in the future of this canal as a deep waterway, especially when it is realized how much and how easily this can be increased. Later, Mr. Leighton furnished additional data on the amount of water that could be obtained through a feeder from the St. Joseph and Elkhart Rivers at Elkhart by the way of South Bend to the summit level near Lake Maxinkuckee. The drainage area of Elkhart River above Elkhart is 700 square miles; that of the St. Joseph River above Elkhart is 2,160 square miles, making a total of 2,860 square miles. The lowest month at Elkhart between 1901 and 1906 was September, 1906, at which time the flow was 1,565 second-feet. This is two and one-third times as much as the amount obtained from the combined five streams mentioned above. Adding this to the 654 second-feet from the other streams, the total is 2,219 second-feet. This is enough for 50 complete lockages per day with locks twice as long, twice as wide, and twice as deep as those given by Mr. Leighton, and still leave 259 second-feet in excess. Such a lock would be 696 feet long, 138 feet wide, and 32 feet deep. It would use four times as much water at each operation as the one described by Mr. Leighton, or 247,400 cubic feet more water than the Poe Lock at Sault Ste. Marie. But this is both wider and deeper than would be needed for a ship canal of the most liberal capacity according to present ideas. The locks of the Panama Canal are designed to be only 110 feet wide. By cutting off some of the width and depth of the enlarged lock described above and adding an equivalent volume to its length the lock could be made equal to the largest locks now in use, or considerably larger if need be. It could easily be made of the same dimensions as the Poe Lock, the largest of the locks at Sault Ste. Marie, which is 800 feet long, 100 feet wide, and 21 feet deep on the miter sill. The large, new Canadian lock is 900 feet long, 60 feet wide, and 21 feet deep. The United States engineers are said to be now planning to build a new lock at Sault Ste. Marie 1,300 feet long, 80 feet wide, and 24 feet deep.

There are a few other streams that can be brought into the summit level without much difficulty. The Wabash River could be received at a point above Huntington and the Salamonie could be conducted over to the Wabash quite easily and brought in with the latter stream. The Mississnewa could also be made to contribute, but not so easily. At the time of this writing no official figures are at hand to show the amount of water which these streams would yield. But on a conservative estimate by comparison of the drainage areas with that of the St. Marys River it seems safe to say that the Wabash River near Markle would yield about 40 second-feet; the Salamonie near Warren 30 second-feet, and the Mississinewa below Marion 45 second-feet, making a total for the three streams of 115 second-feet. This added to the previous amount would make 2,334 second-feet.

Something more could also be added to the water supply from rivers by diverting the headwaters of certain streams in southern Michigan into one or the other of the two St. Joseph Rivers. At a point about 15 miles southeast of Hillsdale, Mich., where the eastern St. Joseph turns from southeast to southwest, there is an old abandoned river bed coming from the Tiffin River, about 3 miles northeast. It would be a very easy thing to divert the upper part of the Tiffin to the St. Joseph through this old channel, and by carrying a feeder canal northeast along the side of the eastern slope for 20 to 25 miles farther several of the upper branches of the Raisin River could also be captured. The drainage area thus divertible to Fort Wayne would be about 300 square miles. In the same way some of the upper branches of the Kalamazoo River could be diverted to the western St. Joseph so as to enter the feeder at South Bend. This would amount to about 200 square miles. The 500 square miles of these two areas would yield about 145 second-feet, making the total from rivers 2,479 second-feet. Besides these it is possible that one or two of the head branches of Grand River near Jackson could be brought in. Something would also be received from several smaller streams, like the tributaries of Little River, east of Huntington, and others to the west. If a summit-level feeder were built to South Bend it would capture a number of small streams. These put together would certainly bring the possible grand total from streams up to 2,500 second-feet. All this is from streams alone and represents approximately the amount possible to derive from the available rivers at low stage.

### WATER RESOURCES AVAILABLE BY STORAGE.

The possible resources for water supply from storage in lakes and reservoirs are not included in the above estimates. Ordinary maps on a large scale show 50 to 100 lakes in northeastern Indiana. Prof. Charles R. Dryer, who surveyed 6 counties in the northeastern corner of the State for the State geologist in 1886, says that, counting large and small, there are probably 1,000 lakes, and there are probably half or two-thirds as many more in southern Michigan which could be drawn upon through the rivers mentioned above. The water that might be stored in these lakes if developed to a maximum can not be stated, but would certainly be very large—surely enough to double or more than double the supply available from the streams alone. When to this is added the further possibility of making almost as many artificial reservoirs in this area as there are existing lakes, there can be no longer any doubt whatever that there is available, if fully called into use, water enough for any magnitude of ship canal that can now be foreseen as a possibility, and for any degree of activity which seems likely. The region of the small lakes is a hilly, morainic country, with many valleys and ravines, and is very favorable to the making of artificial lakes. For storage purposes the existing lakes would probably not be drained off below their present levels, but would be raised a few feet by dams and then drained down only to their present levels. According to Mr. Cooley, 3 to 4 per cent of a given area made into lakes or reservoirs will equalize the flow of the streams from that area.

The foregoing is simply a picture of what is possible in the way of a maximum water supply for the long summit level of the pro

posed canal. The facts stated ought to dispel forever all doubts as to the sufficiency of the available supply. Of course, in practice nothing like all this possible supply is likely to be drawn upon at once. Much of it may be better employed for other purposes, at least for the present. The amount diverted to the canal at any given time would probably not be very greatly in excess of that which would be needed to operate the canal, though some considerable excess is highly desirable for the sake of the water power that can be developed from it. If the canal is built at first with a depth of 14 feet, the water for it would probably be drawn from the first 5 rivers named, with the Wabash and Salamonie added, and these would probably be supplemented by a moderate development of storage as a reserve resource against any possible shortage from the rivers. The long summit level would itself have an enormous reservoir effect. It would be like a large lake. If feeders from South Bend and Elkhart and from the Wabash and Salamonie Rivers were run at summit level the total length of the whole level would be close to 200 miles, with corresponding extension of reservoir capacity. This is one of the most desirable of all things for any great canal.

### WATER POWER.

One of the most important benefits to be derived from a canal like that proposed is the development of water power. In Illinois, where the supply of water is practically unlimited and the canal of large capacity, it is designed to develop a great amount of water power under the control of the State and to devote the proceeds to the cost of running and repairs, and also to contribute much toward paying the original cost of construction. It is estimated that the water power there will be worth about $3,000,000 per year. The proposed Michigan & Erie Canal would afford splendid facilities for developing water power at many places—particularly at Huntington, Wabash, South Bend, Elkhart, near Lake Michigan, and at Maumee, and the revenues thus derived should be applied to the expense of running and repairing the canal. The water powers already developed on the St. Joseph River near South Bend are not nearly so advantageously located as they would be if the water were drawn from this canal at South Bend at an altitude of 750 feet (30 feet above the city). But while water power is a very important consideration in connection with canal building, it is not the most important. Measured by the rule of the greatest good to the greatest number it is certainly true that the water of the rivers and lakes confers a much greater benefit upon the people as a whole when used in aid of commerce in canals and canalized rivers than when used for the development of power by cities, corporations, or individuals.

A great saving in the amount of water required to operate locks can be made by any one of several methods; by hydraulic elevator or lift locks, like those on the Trent Canal at Kirkfield and Peterborough, Ontario; by pneumatic lift locks, or by side-chamber locks. Where the water supply is small, such locks make operation possible with only a small fraction of the water needed for the old method. When the water supply is adequate or large, the use of such locks would enable a much larger portion of the water to be used for the development of power.

CONNECTING CANALS.

When the Michigan & Erie Canal is built it will be joined b several important connecting lines. Chief among these is the Miam & Erie Canal, which connects Cincinnati with Lake Erie at Toled by way of Defiance. This canal is still in use and needs only mod erate enlargement to do excellent service as a barge route to an from the middle section of the Ohio River. It would be particularl serviceable for bringing coal from West Virginia and Kentuck and southern Ohio to the North and Northwest, especially if th proposed ship canal gave it direct connection from Defiance t Chicago.

Another important connection would be the Wabash & Michiga Canal connecting with the Wabash Valley. It seems certain that th Wabash River will be canalized up to Lafayette or Wabash and the it would be an easy matter to carry a connecting line up the lowe Tippecanoe and the Monon to join the Michigan & Erie Canal. A Wabash the ship canal could easily be joined again from the Wabas River, so as to bring about in effect a restoration of the old Wabas & Erie Canal, but with much greater capacity and utility. B canalizing White River and the Mississinewa, Indianapolis and othe cities of central and southern Indiana can be brought into connectio with the ship canal and receive the benefits of connection with lak navigation. These smaller branch canals, chiefly for local commerc are proper objects for construction by the State rather than by th National Government.

Another important branch line would be one extending north fro near Lake Maxinkuckee to South Bend and Elkhart. This could b made at summit level throughout and without locks, thus addin largely to the reservoir capacity of the summit level. This branc even if built primarily as a feeder might as well be made navigab to serve the commerce of the cities mentioned, and also to give the the most effective development of water power.

The Wabash & Michigan Canal is certain to be built in the ne future, even if the main ship canal is not. When it is completed th advantages of having a connecting line between it and the Miar & Erie Canal at Defiance, substantially on the line here projecte will become so great that the people will soon regard it as a positi necessity. But instead of allowing construction to take this cour and building the middle link afterwards, making the canal one relatively small capacity, as would certainly be the case if construct in this way, it would seem the part of wisdom and economy to bui the main ship canal as here projected first. After that is finished decided upon, a system of inland waterways for Indiana can planned to better advantage in relation to the ship canal.

## Supplementary Statements on the Proposed Michigan & Er Canal.

By Frank B. Taylor.

The conception of the canal entertained here at the time t printed pamphlet was written was somewhat larger and more elab rate than that which is now being discussed. It was recogniz

clearly that there are difficulties in carrying the canal from Fort Wayne to Chicago by the Rochester and English Lake route, but it was thought, on account of the importance of the canal to national commerce, the Government would rather meet and overcome these difficulties, which are not by any means insurmountable, than to take some other route which has less certainty of adequate water supply for its summit level.

If for any reason the direct route from Rochester to Gary or Chicago is given up and the terminus is placed at Michigan City, it becomes desirable to reconsider briefly the advantages and disadvantages of the several alternative routes from this point.

The altitude or relief of the land along the great interlobate glacial ridge in northeastern Indiana and southern Michigan is shown by a map founded on data collected mainly by Mr. Frank Leverett, geologist in the United States Geological Survey, in the preparation of a topographic map of this region to be used in a monograph, which is now in the hands of the editors at Washington. It is this great ridge which forms the chief obstacle to a direct line canal. It is highest around Hillsdale, Mich., and declines gradually southwestward to a point 20 miles west of Logansport. Ind. The ridge extends at about the same height northeast in Michigan to Lapeer County, 50 miles north of Detroit.

The canal must cross the ridge somewhere. Preferably it should follow the straightest course possible from Michigan City to Toledo, but by necessity it must have enough water at its summit level to do the expected amount of business, and it is also highly desirable that it shall have as few locks as possible. The four suggested routes cross the ridge at altitude of 420, 320, 270, and 170 feet, respectively, above Lake Michigan. The higher the level at which the canal crosses the ridge the smaller the area of country which can be drained into the summit, and hence the smaller the supply of water at that point. On the Pigeon Creek route, which is the shortest, the canal would cross at an altitude of 420 feet above Lake Michigan. The total area drainable into the summit is less than 1,000 square miles. This seems entirely inadequate for a canal of the size proposed and carrying the commerce it is presumed to serve. The Churubusco route is only about 25 miles longer and crosses the ridge at a level about 100 feet lower, or 320 feet above Lake Michigan. This gives a possible drainage area for the summit two or three times as great as for the Pigeon Creek route. But on account of the roughness of the high ground it would be difficult to bring water to it from the northern part of the area.

By the 320-foot contour several long morainic spurs project northwest from the main high ridge near the State line and would require deep cuts or tunneling to get feeders through them or very long detours to get around them if water is to be brought from Michigan and from an area any larger than that tributary to Pigeon Creek route. It is a close question for the engineers to decide whether water enough can be obtained for the summit level on the Churubusco route.

The Silver Lake route would be nearly 25 miles longer than the Churubusco route, but would pass through on a summit level 50 to 60 feet lower (270 or 260 feet above Lake Michigan). To do this would require one deep cut through a clay ridge 2 or 3 miles wide

near Silver Lake. But the slopes of the land on the sides of the grea ridge are more gentle at lower altitudes and would furnish a con siderably larger drainage area tributary to the summit than for th Churubusco route. If the main line of the canal is to be take through Goshen and Elkhart it would seem necessary to choose on or other of these two routes.

If a great canal built for all time and made to serve the great com merce of the future is contemplated, the original project or a modi fication of it seems to offer a more certain result, a larger and mor certain capacity for service. The lowest point on the western rim o Lake Erie is at Fort Wayne. In the original plan the summit leve of the canal was designed to run from Fort Wayne to a point nea Maxinkuckee Lake without any locks. Here it was to be joined a the summit level by a feeder from South Bend. The altitude of thi level is 170 feet above Lake Michigan, and it is the lowest possibl summit level between the two lakes. The feeder can be made a par of the main line of the canal to South Bend, and this would give stretch of canal from Fort Wayne to South Bend 150 miles long an without any locks. A feeder entering at South Bend, coming in fro Elkhart and Goshen, would be a necessity in this plan and could a well be made navigable to these cities.

The canal would not descend to the Wabash River at Huntingto nor at the city of Wabash, as some have supposed, but would take course along the high ground north of these places at a level 170 fee above Lake Michigan. This route would gather the greatest quantit of water into the summit level that can be obtained for any cana between Toledo and Lake Michigan, and there would be only on summit on the whole canal. Between 6,000 and 7,000 square miles o country can be drained into this summit level, and in this area ther are hundreds of lakes, and also hundreds of other favorable sites, fo reservoirs. There is not the slightest possible doubt of obtaining a adequate water supply for the summit level if this route be taken, eve if the canal should be made 20 or 25 feet deep instead of the 16 fee proposed, and the locks should be operated 100 times a day.

This great water supply and the long, low summit level are th great advantages of this route. The only disadvantage is its greate length. By close measurement it is found that the canal by th Rochester route would be 55 or 60 miles longer than the Churubusc route and 35 miles longer than the Silver Lake route. But this di advantage is largely offset by other undesirable conditions of th other routes. The slopes of the country on all the routes are s gentle that locks of large lifts would necessitate much extra deepe ing of the canal bed on the lower approaches to the locks and heav embankments on the upper approaches, greatly increasing the cost c construction without adequate compensation. Locks of 20 or 2 feet lift are as great as can be economically constructed on thes routes. On the Churubusco route the canal would have to rise 15 feet above Fort Wayne to the summit near Tippecanoe Lake, a fe miles west of Churubusco, and descend the same amount to Elkha on the north side. This needs 12 locks of 25 feet lift each to g over the hill from Fort Wayne to Elkhart. It is sometimes claime that the 18-foot lock at Sault Ste. Marie, Mich., can be operated i 20 minutes, but as a matter of fact it is seldom less than 30 minut

and is often considerably more. It takes longer to operate a 25-foot lock than an 18-foot one. The Silver Lake route would require about six 25-foot locks between Fort Wayne and Elkhart. It is a conservative estimate to say that on the average a single-going barge would lose at least 8 or 10 hours of time in passing through the 12 locks of the Churubusco route between Fort Wayne and Elkhart, and it would lose half that much on the Silver Lake route. But if the barges go in fleets, as they certainly would, and if each lock accommodated say two barges at one operation, then the whole fleet would have to wait at each lock until they all got through. This means a doubling in the loss of time for fleets of three or four barges. On the Churubusco route a fleet would therefore lose 18 or 20 hours of time between Fort Wayne and Elkhart. On the Silver Lake route it would lose 8 or 10 hours.

The Rochester route to South Bend and Michigan City would have no locks between Fort Wayne and the former place. At the rate of 4 or 5 miles an hour a barge fleet would go the 60 extra miles of this route as compared with the Churubusco route in 10 or 15 hours. A fleet would therefore reach South Bend by way of Rochester between 5 and 8 hours sooner than by way of Churubusco and 3 or 4 hours sooner than by way of Silver Lake.

Ordinarily the most expensive thing in canal construction is the building of the locks. This is particularly true on a route like this one, where the excavation will be nearly all in clay with almost no rock. The building of the canal on the Rochester route would therefore save not only the cost of construction of the locks of the shorter routes, but would save several hours of time for every barge fleet that used the canal after it is built.

These, it seems to me, are the essential elements of the problem. The physical characters and the water supply for the summit of the Rochester route are discussed in the printed pamphlet and would not be materially altered if now rewritten. If the men of commerce in New York and Chicago, in Buffalo and Cleveland, in Toledo, Fort Wayne, South Bend, and Defiance; if the civil and United States engineers, the National Waterways Commission, and the Members of Congress look at this project in the broad way which seems necessary in providing for the future needs of the people in national trade and commerce, it is believed that they will build this canal by way of the Rochester route either to South Bend or Michigan City or else directly to Gary and Chicago.

The crossing of the Kankakee River and getting through the high morainic ridge near Valparaiso without establishing a most undesirable second summit level for the canal are the greatest difficulties of the direct route to Chicago. These obstacles may be entirely avoided, however, by turning the canal north over an easy route to South Bend and Michigan City. Commercially the two routes are about equal in service to commerce. The direct route to Chicago is much the better for national commerce. The South Bend route would make the path for national commerce longer, but would serve the cities of northern Indiana better. The detour to South Bend and Michigan City will aid the commerce of those places, but would add about 40 miles to the length of the water route between New York and Chicago. The only gain by building the canal on any of the

shorter routes would be a shortening of the total length of the canal. On account of the cost of locks the original cost of construction would probably be less on the Rochester route than on any of the shorter lines. Even if it were not, the loss of time which barge fleets would experience in going through the locks of the shorter routes would in a few years much more than overbalance the extra cost of construction.

When the National Government undertakes to do a good and necessary thing for the people which they can not well do for themselves it ought to do the best thing possible within bearable limits of expense. If the Government is to aid the people in obtaining better means of transportation it ought to give them the best it can, and it can do this only by furnishing the cheapest possible transportation. This is to be attained not in ships nor in single going barges, but in barge fleets, in which several barges travel together as a unit. This canal ought to be constructed with the best service of barge fleets as its main object, and from this point of view it would be a mistake to build a lock-bound canal merely for the sake of a trifling shortening of the distance, when this would involve the operation of a considerable number of locks and would lengthen the time of passage through the canal for all the barge fleets of the future.

# APPENDIX C.

## Description of Harbors.

### ST. JOSEPH HARBOR AND RIVER, MICH.

St. Joseph Harbor, at the mouth of the St. Joseph River, has been under improvement since 1836. The present project for its improvement provides an entrance channel, 18 feet deep, between parallel piers, and an interior channel, 18 feet deep and 150 feet wide, along the city front of St. Joseph. House Document No. 307, Fifty-fifth Congress, second session, contains a map of these improvements. The St. Joseph River was surveyed from its mouth to Elkhart, Ind., in 1880. (See Annual Report, Chief of Engineers, 1880, Part III, p. 2049, maps not printed.) The condition of the river at that time, as well as at a previous period, is described, and a plan and estimate made for its improvement to Elkhart. Eleven locks were required and the total cost of the improvement estimated at $634,331, from which was omitted the cost of the land necessary for the work, the damages which might arise by the flooding of land, the value of water-power rights, etc. It is to be noted that in 1866 a steamer of about 200 tons made regular trips between South Bend, Ind., and the mouth of the river. The construction by private parties of dams at South Bend and at other places downstream without locks and dams now prevents such use of the river. A project was adopted in 1899 for securing a depth of 3 to 4 feet from St. Joseph to Berrien Springs, a distance by river of 25 miles, by the removal of snags and bowlders, and the construction of wing dams. As the result of an expenditure to June 30, 1910, of $6,246.26 many of the worst places in the stream had been improved to the required extent.

Michigan City Harbor, which is mentioned in this report as the best location for the western terminus of a Lake Erie–Lake Michigan Canal, has been under improvement since 1836. Bulletin No. 20, Survey of Northern and Northwestern Lakes, contains, at page 172, a full description of this harbor.

The works of improvement at the mouth of Trail Creek, forming Michigan City Harbor, consist of: (1) Two parallel piers, about 215 feet apart, at the mouth of the creek; and (2) a detached breakwater in the lake in front of these piers, protecting the channel entrance. The projected depth of the entrance channel between the piers is 15 feet below Chicago City datum, and there are sufficient funds on hand to provide this depth. To the east of the entrance channel a basin or outer harbor, having an area of about 34 acres, was formed by the construction of two piers and the eastern entrance pier. The basin was dredged to a depth of 14 feet. The entrance to the basin was originally 465 feet wide, but by an extension of the eastern entrance pier has been reduced to 15 feet, and is now located at a point about 1,790 feet from the outer end of the eastern pier. The channel of Trail Creek was improved by dredging for a distance of about 2 miles

from the harbor entrance, with a width of from 120 to 150 feet and depth of 13 feet to Eighth Street and 4 feet to the upper turning basin. Shoaling has caused a reduction in depth and width in this channel.

### MAUMEE RIVER AND TOLEDO HARBOR.

The harbor of Toledo, as at present developed, extends from the head of Maumee Bay about 7 miles up the Maumee River. The present object for its improvement provides for a channel 400 feet wide and a depth that will secure a navigable channel way of 21 feet, which requires a depth of about 23 feet at mean lake level, from deep water in the lake to the Fassett Street Bridge, a distance of about 14 miles. The total expenditures on this project to June 30, 1910, was $992,461.89, of which amount $159,489.55 was for maintenance. The result of these expenditures has been to create and maintain a channel through Maumee Bay and River 400 feet wide and 20 feet deep to Fassett Street Bridge, a distance of 15 miles, and to a width of 100 feet and depth of 20 feet for 1 mile above this bridge. The Maumee River is also navigable for launches to Perryburg, about 7 miles above Toledo.

### KANKAKEE RIVER, ILLINOIS AND INDIANA.

The Kankakee River has been examined at various times (see A. R., C. of E., 1868, p. 459; 1879, p. 1455; 1880, p. 1844; 1884, p. 1766; 1885, p. 1645), and reported to be navigable as far as Baums (Eaton's) Bridge, about 120 miles above Momence. (Eaton's Bridge is within the limits of the lines examined by Maj. Gillespie for a canal connecting Lake Michigan and the Wabash River.) A survey of the river was made in 1879 up to Momence, Ill., with an estimate for canalization of $550,000. A private corporation and the State of Illinois canalized the river by locks and dams in its lower 33 miles.

### WABASH RIVER, INDIANA AND ILLINOIS.

The Wabash River has been examined and surveyed at various times from Lafayette, Ind., the terminus of the Erie & Wabash Canal, to its mouth. Various projects for its improvement have been adopted and some work has been done on these projects in the lower part of the river. The upper river was not considered worthy of improvement, because of obstructions due to bars and bridges and the character of its banks (A. R., C. of E., 1890, p. 2412).

The Miami and Erie Canal connects with Swan Creek (tributary to Maumee River at Toledo) 1¼ miles above its mouth. The original canal had the following dimensions: From Toledo to junction (with Wabash and Erie Canal), a distance of 64 miles, the top width was 60 feet, the bottom width 46 feet, and the depth 6 feet.

### ERIE AND WABASH CANAL.

For history and description, see Annual Report, Chief of Engineers, 1881, Part III, page 2349.

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# RAILWAY RATES, INLAND WATERWAYS AND CANALS IN THE RUSSIAN EMPIRE

REPORTED BY

JOHN H. SNODGRASS

AMERICAN CONSUL GENERAL AT MOSCOW

WASHINGTON
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# RAILWAY FREIGHT RATES, INLAND WATERWAYS, AND CANALS IN RUSSIA.

By JOHN H. SNODGRASS,
*American Consul General at Moscow.*

This report is in answer to questions prepared by the National Waterways Commission and the Department of Commerce and Labor and transmitted to American consuls through the Department of State.

## CHAPTER I.

### QUESTIONS RELATING TO FOREIGN RAILWAY RATES SUBMITTED BY THE NATIONAL WATERWAYS COMMISSION THROUGH THE DEPARTMENT OF STATE.

I. Give ten examples of rates on coal on different railway lines for different distances, with the following details:

(*a*) Give termini for each shipment.

(*b*) Give distances of each shipment, including in the list of ten rates at least three rates for the maximum distance that coal is shipped.

(*c*) Give separately the terminal and transportation charge. (If this is not possible, make note of the fact that the two are combined.)

(*d*) State what service is covered by the terminal charge.

(*e*) State the class of rate into which the coal traffic falls; that is, whether the rate is a special or commodity rate or a normal class rate, and, if the latter, what class.

(*f*) Give all other facts concerning method of shipment which affect the rate, such, for example, as minimum carload weight or minimum train load, open or closed cars, fast or slow freight, and the like.

(*g*) If any of these rates have been given to encourage the development of any industry, state the facts.

II. Answer the above seven questions (*a* to *g*), quoting in each case ten examples of rates on different railway lines for different distances for the following commodities: 1, iron ore; 2, stone; 3, lumber; 4, fertilizer; 5, grain.

III. Give ten illustrations of special rates granted to export business on different railways for different distances, and answer in each case the questions propounded above for the coal traffic (*a* to *g*) so far as they are applicable to the export business. Make a statistical tabulation comparing these export rates with local rates between the same termini.

IV. Give ten illustrations of rates charged by different railways for different distances on the highest grade of classified freight, that which, in many countries, corresponds to the express business of the United States, and answer in each case the questions propounded for the coal traffic (*a* to *g*).

V. Give ten illustrations of rates charged by different railways for different distances on typical products included in the various categories of the regular freight classification, showing both carload and less than carload rates, and answer in each case the questions propounded for the coal traffic (*a* to *g*).

VI. Are the freight rates based absolutely on distance, or is the rate per ton-mile less for longer distances? Show, in the case of different commodities, at what distances the fall in the rate per ton-mile takes place.

## Chapter II.

### QUESTIONS SUBMITTED BY THE DEPARTMENT OF COMMERCE AND LABOR THROUGH THE DEPARTMENT OF STATE RELATIVE TO RIVERS AND CANALS IN FOREIGN COUNTRIES.

#### I.—PUBLIC SUPERVISION.

(*a*) State what public authority, national, State, or local, exercises supervision in the different instances over navigable streams and canals.

(*b*) What are the powers and duties of such officials in regard to the following:

(1) Capitalization of navigation corporations.
Regulation of freight rates.
Reports of operation.
Maintenance and improvement of channels, docks, and terminal facilities.

(2) Collection of statistics of water-borne traffic, and by what agencies such statistics are compiled and published.

#### II.—WATERWAY IMPROVEMENTS.

(*a*) Is there any established policy as to water powers developed by works constructed for improving navigation? Give illustrations.

(*b*) To what general extent have river improvements and the construction of canals been carried on by the central government, by local governments, and by private enterprise? Give typical and important illustrations of each. Describe any system of cooperation and contribution between the central government and local government in such works.

#### III.—FLOATING EQUIPMENT.

(*a*) What is the general character of vessels used on rivers and canals?.

(1) The relative use of self-propelled vessels and towed vessels.
(2) Motive power for barges and canal boats.
(3) Size and draft of vessels.
(4) The use of iron, steel, and wood in vessel construction.
(5) The cost of various types of boats.
(6) The use of special types of boats for particular cargoes and on different classes of waterways.
(7) The size of fleets of barges.
(8) Is the type of boats adapted to low-water stages, or are they constructed with a view to utilization in high water?

In each case specific information is desired showing the situation in typical instances rather than general statements of a summary character.

#### IV.—OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATION.

(*a*) Do canal companies or other waterway improvement companies own and operate vessels? Give examples.

(*b*) Are there important cases of consolidation of vessel owners into large corporations operating extensive fleets on inland waterways?

(*c*) To what extent are vessels owned and operated by railroads, or by producing and distributing concerns, such as coal, oil, lumber, ore, etc., fleets? Give examples.

(*d*) Are there any fleets of merchant vessels owned and operated by public authorities? Give examples.

(*e*) Are there important instances of combinations or monopolies controlling towing on canals and rivers? Give examples.

#### V.—TERMINAL FACILITIES.

(*a*) What are the important or striking physical features of river and canal terminals such as docks, wharves, piers, and floating wharf boats? Give illustrations and send photographs with this answer.

(*b*) Describe the most advanced methods of loading and unloading vessels on inland waterways, including the use of mechanical appliances.

(*c*) Are railroad tracks located on terminals of inland waterways, permitting direct transfer between railroad and water lines? Do such railroad tracks form a belt railroad, connecting all the railroads at a given port? Give examples.

(*d*) Are river and canal terminals owned by public or private interests? Are they owned at all by private railways? If so, give the important instances.

### VI.—TOLLS AND FREIGHT RATES.

(*a*) Are tolls charged on canals and rivers? If so, what elements are considered in framing them and what service do they cover? Are there separate tolls for boats and cargo? Give typical illustrations.

(*b*) What elements enter into the making of towing rates on canals and rivers? Give illustrations of towing charges and send copies of any tariffs or towing rates.

(*c*) Do inland water lines have regular schedules of freight rates and classifications of freight? Are the rates stable or do they vary frequently with traffic exigencies? Give illustrations.

(*d*) How are inland waterway rates affected by—

(1) Distance of haul?
(2) Quantity of commodity offered?
(3) Speed?
(4) Character of commodity?

Give illustrations on important waterways.

(*e*) Do prorating arrangements exist between water lines and railroads, and to what extent? Give illustrations and send copies of joint rail and water tariffs.

(*f*) How do inland water rates affect railroad freight rates? Are railroad freight rates to water competitive points higher than to interior nonwater points of similar distances? Give illustrations.

Compare inland water rates with paralleling railway rates for short and for long distances, giving specific illustrations which shall show whether waterways have greater competitive power in the one case than in the other.

(*g*) What is the general attitude of rail and water lines toward each other? Is there active competition or are there agreements for the division of traffic? Give examples.

(*h*) Is there any legislation regulating the relations between rail and inland waterway systems of transportation? Is there any governmental restriction on the lowering of rail rates in competition with water rates? Give examples.

(*j*) Is it customary for shippers of goods by inland waterways to insure them, or is the risk assumed by the carrier? To what extent does this affect the freight rate? Give examples.

### VII.—WATER-BORNE TRAFFIC.

(*a*) What is the general character of traffic on inland waterways: The principal commodities moved, the proportion and character of traffic moved in different directions, relative importance of package and bulk freight, etc. (This should be answered specifically for different waterways.)

(*b*) Send official publications giving, for the last ten years, available statistics of vessel movement and traffic carried on inland waterways; also railroad traffic, tonnage, and ton-mileage.

(*c*) Taking important inland water routes, does local traffic or other traffic predominate, and in what general proportion?

(*d*) Give a concise statement of typical conditions of labor which is employed in navigation and in terminal handling, particularly with reference to wages paid.

NOTE.—The above questions were revised by the members of the National Waterways Commission.

# CHAPTER I.

## RAILWAY FREIGHT RATES IN RUSSIA.

### INTRODUCTORY.

Although Russia occupies one-sixth part of the surface of the globe, it controls less than 50,000 miles of railway, or about one-fifth the mileage of the United States, from which the gross receipts in 1908 amounted to $406,544,264, a decrease of $3,632,165 from the year previous.

However, including Siberia and central Asia, but exclusive of Finland, Russia ranks second only to the United States in its railway mileage.

According to the latest figures available, the proprietorship of the Russian railways is—Government-owned lines, 33,210 miles; private, 16,764; or a total of 49,974 miles. These are divided as follows:

LENGTH OF RAILWAY.

| | Government. | Private. | Total. |
|---|---|---|---|
| | *Miles.* | *Miles.* | *Miles.* |
| Regular traffic | 28,262 | 13,381 | 41,643 |
| Temporary traffic | 191 | 46 | 237 |
| Under construction | 1,527 | 1,034 | 2,561 |
| Construction sanctioned | 1,275 | 1,056 | 2,331 |
| | 31,255 | 15,517 | 46,772 |
| Finland | 1,955 | 169 | 2,124 |
| Eastern-Chinese Ry | ---------- | 1,078 | 1,078 |
| Total | 33,210 | 16,764 | 49,974 |

GROSS RECEIPTS.

| | 1908 | 1907 | Increase (+), decrease (−). |
|---|---|---|---|
| Government railways | $286,254,586 | $291,854,446 | −$5,599,860 |
| Private railways | 120,289,678 | 118,321,983 | + 1,967,695 |
| Total | 406,544,264 | 410,176,429 | − 3,632,165 |

The number of passengers carried on all Russian railroads was 155,383,972 in 1908, against 148,280,354 in 1907, an increase of 7,103,618.

In Russia the expense of building, extending, and improving railways is covered by special resources, some of which are never employed for such purposes in the rest of Europe and America. Part of the construction, etc., is carried on, as in western Europe, by means of the share and debenture capitals of joint-stock companies. In a vast majority of cases, the debenture capital is guaranteed by the Government, and this is sometimes the case in regard to the share capital also. Of the railways thus built, many were, at various times, bought out by the State, and the holders of the companies' bonds and shares received, in exchange for these, Government bonds specially issued for the purpose. Such bonds are included in the national debt, forming about 30 per cent of it.

What distinguishes Russia from western Europe in regard to railways is the magnitude of the capital expended on railway building and development, without recourse to the issue of securities, but merely from the resources of the ordinary budget and its surpluses. In the ordinary budget of the Empire there is annually an assignment of 84,000,000 rubles ($43,260,000), on an average, for the improvement and increase of efficiency of the State railways; that is, construction of second tracks, extension of stations, replacing simple bridges by better ones, acquisition of extra engines and cars, etc. In other countries such expenditure is covered by supplementary issue of bonds, so that, while the length of the railway hardly varies, their debenture capital is annually increasing at a very considerable rate.

Besides the grants in the ordinary budget for the aforesaid purpose, assignments are made under the head of extraordinary expenditures to the amount of about 100,000,000 rubles ($51,500,000) per annum for the construction of new railways by the State. In the budget this expenditure is covered by the free balance of the treasury, but on the fulfillment of the budget it is invariably found that in the ordinary budget the excess of revenue over expenditures is far greater than had been estimated, and the yearly surplus is sufficient to cover the extraordinary expenditure on the construction of new railways. In other words, during the last 10 years the Russian Government spent up to 1,834,000,000 rubles ($944,510,000) of its ordinary revenue on increasing the efficiency of its railway net, and on building new lines.

Another feature of Russian railways is that some lines (for instance, the Eastern-China Railway), were constructed by so-called joint-stock companies, whose whole share and debenture capital had been bought up by the Russian Government, no securities whatever being issued to refund the money thus invested by the State. In other words, such lines were likewise built exclusively at the expense of State finance, and the requisite outlay, as well as the expenditure on new State lines, was covered solely by the surplus of the ordinary budget. All this will be easily grasped if one calls to mind the fact that in Asia the Russian Government owns, among other things, 8,000 miles of railway (the Trans-Siberian, Orenburg-Tashkent, etc.) for the construction of which not a single bond or share was issued, and that the Eastern-Chinese Railway, although nominally not the property of the Russian Government, is totally unknown to the public by its shares or bonds.

The following is a summary in tabular form of the Russian State railway system as at March 31, 1907:

| | Miles. |
|---|---|
| **Lines in European Russia:** | |
| South-Western Rys | 2,664 |
| Moscow-Yaroslav-Arkhangelsk Ry | 1,981 |
| Southern Rys | 1,993 |
| Ekatherina Ry | 1,813 |
| North-Western Rys | 1,679 |
| Vistula Rys | 1,436 |
| Perm Ry | 1,376 |
| Nicolas Ry | 1,229 |
| Riga-Orel Ry | 976 |
| Polessye Rys | 897 |
| Syzran-Viasma Ry | 865 |
| Libau-Romny Ry | 852 |
| Samara-Zlatoust Ry | 827 |
| Moscow-Brest Ry | 688 |
| Moscow-Kursk Ry | 378 |
| Moscow-Nijni Novgorod Ry | 377 |
| Baskuntshak Ry | 44 |
| Total | 20,075 |
| **Lines in Asiatic Russia:** | |
| Trans-Siberian Ry | 2,083 |
| Trans-Baikal Ry | 1,123 |
| Tashkent Ry | 1,391 |
| Trans-Caucasian Ry | 1,016 |
| Central Asian Ry | 1,578 |
| Total | 7,191 |
| **Besides these:** | |
| East China Ry. (nominally belongs to a company) | 1,078 |
| Ussuri Ry. (temporarily leased to East China Ry.) | 558 |
| Total | 1,636 |
| Grand total for the State railways | 28,902 |
| **Railways operated by companies:** | |
| Riazan-Ural Ry | 2,387 |
| South-Eastern Ry | 2,154 |
| Moscow-Kiev-Voronesh Ry | 1,551 |
| Moscow-Windau-Rybinsk Ry | 1,632 |
| Moscow-Kasan Ry | 1,395 |
| Vladikavkas Ry | 1,555 |
| Warsaw-Vienna Ry | 471 |
| Bogoslovsk Ry | 130 |
| Bielgorod-Sumy Ry | 98 |
| Lodz Factory Ry | 50 |
| Other lines | 1,436 |
| Total | 12,859 |
| Grand total of State and corporation railways | 41,761 |

The following new enterprises are, in principle, decided upon by the ministry of ways and means of communication:

(1) A second track for the existing Siberian line. The plans and estimates are made, according to which the cost of construction amounts to $72,100,000.

(2) A new railway line in Siberia, to join the existing line with the Far East on the Pacific. Investigations and surveys for this work are in progress. The approximate cost is estimated at $133,900,000.

(3) A new railway line from Tashkent to Tomsk, joining the lines of central Asia with the Siberian; surveys are in progress. The approximate cost is estimated at $61,800,000.

(4) Small lines in European Russia are being started by private companies, some of them being guaranteed by the Government.

(5) Two canals between two large rivers, joining the Black Sea with the Baltic. All the existing canals are also to be deepened so as to admit vessels and barges with a draft of 14 feet. This system is planned with a view to the encouragement of local traffic and the transit of small sea vessels from one sea to the other. The approximate cost would be $193,125,000, including interest for five years, redemption of capital, and sundry expenses.

(6) Several irrigation canals in central Asia, to water very good land fit for cotton plantations and other purposes. The entire cost of the system is estimated at $154,500,000, but, of course, it will have to be executed gradually in small sections.

The possibility of connecting the Russian with the Indian railway system has been frequently mooted. It is rather a political than an economic question, and has hitherto been opposed solely by the military party in the Russian Government.

I have already mentioned that the Russian Government is prepared to guarantee the capital of companies operating railroads under certain conditions. These conditions are as follows: (*a*) Railways which are of no commercial importance, but are useful from a strategic, imperial, or economic point of view, are built principally by the State, while railway companies are left to construct such lines as are likely to prove sufficiently remunerative in the near future; (*b*) the share capital of a railway company must form no less than one-third of its whole capital; (*c*) railway bonds guaranteed by the Russian Government are guaranteed absolutely, from the very day of issue, irrespective of the completion or noncompletion of the line in question. It is therefore obvious that the right of issuing such bonds is granted exclusively to syndicates whose reliability and solvency are beyond all doubt. Practically all such issues are invariably made through the medium of first-class banks. It is likewise understood that the proceeds of such issues are to be transferred to the respective railway companies by installments as certain sections of the line are completed and that a certain amount of the proceeds is to be paid to the company only when the whole line is open for regular traffic.

The capital expenditure of the treasury on State railways from the resources of the budget during the period from 1898 to 1908 is given below. It should be noted that in the estimates of the budget the outlay on new railways is entered under extraordinary expenditure, but as the actual ordinary receipts are considerably in excess of the actual ordinary expenditure, all the capital outlay on the State railway net is, in the end, practically covered by the resources of the ordinary budget:

| Years. | Expenditures on new railways. | New works on existing lines.[1] | Years. | Expenditures on new railways. | New works on existing lines.[1] |
|---|---|---|---|---|---|
| 1898 | $58,689,400 | $44,346,650 | 1906 | $21,805,100 | $38,367,500 |
| 1899 | 53,687,500 | 40,860,100 | 1907 | 25,034,415 | 38,346,900 |
| 1900 | 30,482,850 | 46,437,550 | 1908 | 30,580,700 | 40,721,050 |
| 1901 | 21,799,950 | 43,254,850 | | | |
| 1902 | 85,314,900 | 51,932,600 | Total | 501,279,415 | 484,141,200 |
| 1903 | 87,256,450 | 51,247,650 | | | |
| 1904 | 49,151,600 | 46,525,100 | Grand total | | 985,420,615 |
| 1905 | 37,476,550 | 42,101,250 | | | |

[1] Laying second tracks, building and improving bridges, stations, etc., increasing the amount of rolling stock, etc.

## FREIGHT RATES ON RUSSIAN RAILWAYS.

One of the most complex problems with which the commercial world in Russia has to deal is railway freight rates, and even those in the public service know but little concerning the question.

Nearly all the large firms have rate specialists attached to their offices whose duties are to interpret and follow closely the numerous changes that take place from day to day. The rates never remain fixed for any length of time, but vary according to the demands made by shippers in various parts of the country.

In questions of tariff the railways were never free to do as they pleased, legally speaking, at the formation of the railway companies. Their power of fixing rates for the transportation of passengers and goods was to a certain extent controlled by a so-called limiting or statute tariffs, which still remain in force on the private lines. In some of the later statutes of railway companies, in addition to the limiting maximum rates, there were also minimum tariff rates for conveying goods.

In addition to these limitations other restrictions have been imposed which companies are bound to respect, when fixing and altering the tariffs, and in virtue of which they are required, in certain cases, to present their new propositions to be sanctioned and approved by the Government. As these regulations were too indefinite and incomplete, the result was the railway companies fixed freights below the limiting rates for the most part, and these were made too high. Therefore, the lines acted independently and regulated their tariffs accordingly, and the interests of other lines and the Government and the requirements of trade were not considered, there being no control or direction by the State.

The natural consequences of this system were soon apparent—

Says the minister of ways and means of communication, in his review of the upbuilding of the present tariff system—

At the end of the seventh decade the tariffs of the Russian railways were already in such a state that they elicited universal complaint and discontent from these private individuals and establishments whose interests depend upon railway rates, which were then characterized by the utmost diversity, complexity, instability, and inequality. There were normal, local, special, differential tariffs, and tariffs of direct communication within the limits of one group, specially arranged tariffs between two or more lines or groups, and finally a mass of exceptional, explanatory, supplementary, and modifying paragraphs. Hence arose such complication of the accounts of the lines, both with those who forwarded the goods and with other lines, that not only the public, but even

the railway agents themselves, had the utmost difficulty in disentangling the confusion, and they constantly fell into errors which resulted in mutual recrimination, complaints, and disputes. The extreme instability of the railway rates, the arbitrary changes made with a total absence of regular or timely publication, and unjust advantages and discounts made to favored individuals, caused enormous losses in trade and industry and prevented business from being carried on upon the basis of true commercial computations. The competition between railway lines in many cases resulted in an excessive diminution of rates which in other cases were, on the contrary, far too high, compared with the value of the goods. In this manner an irregularity of rates was created for various industrial centers and even for separate industries, which had a most injurious influence upon trade and commerce and caused great loss to the State, which guarantees a certain mean income to most Russian railways. Besides this, the system of basing the tariffs upon the sole commercial advantages of joint-stock companies led to the consequence of often paralyzing the activity of various Government measures directed toward the encouragement and protection of native industry.

The question of the necessity of a total reform in railway tariffs and a constant Government control over them arose already before 1880. The commission under the presidency of Count Baranov, after having investigated railway routine, also gave serious consideration to this question and exposed its principal, essential deficiencies. The practical measures taken by the Government toward revising the tariffs were, however, at the commencement marked by their great discretion. In 1881 a law was passed ordering all railway companies to submit all their fixed tariffs and proposed alterations to the ministries of finance, and ways and means of communication, and to the State control. In 1883 the highest general scales of supplementary dues were fixed and an obligatory nomenclature with an alphabetical list of goods was introduced on all railways. In 1885 the General Statute of Russian Railways was issued, which is in force up to the present time; it, however, only contains the few following general rules, referring to tariffs and supplementary dues. According to paragraph 68 of this statute the carriage and supplementary dues must be calculated according to the legally published tariffs and regulations concerning supplementary dues. According to paragraph 71 all departures from the rules and exclusive advantages or preferences in favor of any separate parties are strictly forbidden. Paragraph 72 forbids any excess charges above the fixed tariffs, and enacts that any excess charges which are unclaimed by the sender before the lapse of a year, shall be handed over to the State.

In 1886 the tariffs for direct communication with foreign countries were subjected to Government control and sanction. All these separate measures did not, however, bring about the desired result of regulating the tariff department of Russian railways. In 1887, therefore, the council of the Empire, upon examining this question, recognized that it devolved upon the Government to take the direction of the actions of the railway companies in fixing tariffs with the view of safeguarding the interests of the population, trade, industry, and the State, and commissioned the ministers of ways of communication, Crown domains, finance, and the State control, to work out the best means of accomplishing a Government inspection of railway tariffs. In pursuance of this, from March 8, 1889, a new special law was promulgated and enforced concerning railway tariffs and institutions connected with tariff matters, and not only were definite regulations fixed and the mode of action of the Government in railway tariff matters laid down, but besides this special departments were established in the ministry of finance for reforming the tariffs, and then gradually assuming the direction of tariff matters. The system of Government inspection and supervision of tariffs in Russia in vogue at the present time is based upon this law and the regulations issued during its further development.

The following is in general terms an exposition of this system: The tariffs of all Russian railways open to the public, whether owned by the State or by private individuals, are subjected to Government supervision and guidance. By the word tariff is not only meant the payment for carriage but also all supplementary and other dues levied by the railway lines and the regulations applying to these rates and dues. The direction of the Government is enforced in (*a*) determining the basis of the tariffs; (*b*) in fixing rules for composition, introduction, application, and alterations of tariffs; (*c*) in enforcing the

strict observance of these rates and rules, and in removing any departures from them which may be discovered; (*d*) in observing that the tariffs are in accordance with the interests of the public, trade, industry, and the State; (*e*) in resolving the question concerning the distribution of rates and other dues amongst the railways, to abolish competition and mutual agreements between railway lines or other modes of transport and likewise between private companies and individuals in those paragraphs of the agreements concerning tariffs and the conveyance of passengers and goods. Propositions concerning changes in or additions to the actual tariffs and also concerning the establishment of new tariffs are schemed by the railway companies or meetings of their representatives, but can not be enforced without having previously been examined by the Government tariff department.

All propositions referring to tariffs are presented to the ministry of finance, with a full explanation of their basis, and it depends upon the ministry to suspend the application of the new tariff, or even to veto it altogether. If in the course of six weeks the ministry does not present any obstacles to applying the new tariff, it may be enforced in just the same way as if the ministry had given its consent. If the introduction of a new or any alteration in an existing tariff is necessitated by the interests of the public, trade, industry, or State, the question may be agitated outside the railways, by competent Government or public institutions and by societies having a statute confirmed by the Government whose duty is to watch over the economic interests of the population and to satisfy the wants of trade and industry. Questions agitated in this manner, if the ministry of finance considers it necessary to give them further impulse, are handed over for preparatory consideration to those railways to which they refer, or in case of necessity, to a meeting of their representatives. However, should the railways omit to send any report by the required time, this will not prevent the question from receiving further consideration. The railways are bound to adopt the decisions of the Government tariff institutions on all questions of rates.

No new rates can be introduced otherwise than in strict accordance with the regulations concerning composition, publication, introduction, and annulment of tariffs. The railway lines and meetings of their representatives are bound to supply the ministry of finance with all statistical and other data in their possession required for the solution of tariff questions and also to exhibit to persons appointed by the ministry all books and documents required for checking the action of railway lines in connection with rates.

Such are the elements of the system of Government supervision and inspection of Russian railway tariffs based upon the law of March 8, 1889. All this business is managed by three institutions attached to the ministry of finance, namely, tariff council, a tariff committee, and the department of railway affairs.

The tariff council, being the highest, is destined for the solution of the most important and general questions on rates. It is presided over by the minister of finance and consists of his assistant, the directors of the departments of railway affairs and of trade and manufactures, of two members from the ministry of ways and means of communication, of one member from each of the other ministries, three representatives of agricultural industry, two representatives of trade and manufactures, one representative of the mining industry, and three representatives of private railway companies. The council has under its jurisdiction the forming of regulations concerning the composition, publication, introduction, and annulment of tariffs, together with fixing the time of their observance; the establishment of rules for composing, editing, and presenting tariff statistics of the conveyance of passengers and goods; fixing rules for meetings of representatives of railways upon questions of tariff; the indication of general means for avoiding competition between railways and other means of transport and also the distribution of railway dues among them; the consideration of propositions referring to the limiting rates of transport charges and the determination of supplementary and other dues. Besides all these questions some private questions connected with tariffs are in certain cases submitted to the council.

The tariff committee is presided over by the director of the department of railway affairs, and consists of two members from the ministry of finance and one from the ministries of ways of communication, interior, Crown domains, and State control. Representatives of separate railway lines may be invited to the

committee meeting to give explanations, and also delegates from meetings of the representatives of railways, or indeed any private individuals who might be expected to give useful information upon the questions being discussed. The committee therefore decides the most important private tariff questions which are directly connected with the requirements of the public and the wants of industry and trade. The less important questions are passed over to be examined by the committee of the ministry of finance or brought before it in pursuance of the opinion of the director of the department of railway affairs. All business in the committee is decided by a simple majority of votes, and the decisions are enforced if they are not stopped by the minister in order to put the matter before the consideration of the tariff council.

The department of railway affairs has the control over all matters concerning railway rates and other matters referring to railways within the jurisdiction of the ministry of finance. With regard to the tariff department, besides the expedition of the business of the council and committee and their dealings with various departments, railways, meetings, private companies, and individuals, this department is required to examine and consider the propositions of the railway lines and their meetings concerning alterations in the actual tariffs and the questions about tariffs agitated by Government and public institutions; to collect information and data on tariff matters, and to obtain it from the railways; to investigate and work out questions having the purpose of suiting the tariffs to the interests of the public, trade, industry, and the State, and the distribution of freight rates amongst the railway lines in direct communication tariffs; to decide those private questions which do not come within the jurisdiction of the tariff committee; to notify the railways of any new tariff regulations; to supervise the strict observance of the tariff rates and the rules referring to their composition, introduction, application, and annulment.

The decrees of the Government tariff institutions which are not in accordance with the existing regulations, may be appealed against to the minister of finance if they have been confirmed by the department of railway affairs, or to the tariff committee, and to the Senate if the decree has been confirmed by the minister or the tariff council.

Soon after the new tariff institutions commenced operations, some opposition was encountered from certain railways against the endeavors of these institutions to bring the tariffs then in force to suit the general good, and the powers granted to them by the law of March 8, 1899, were found to be insufficient to crush this opposition. Hence, on August 12, 1889, a supplementary law was issued providing for such cases when any railway line or meeting of representatives of railway lines should not present within the term specified by the ministry of finance the scheme of tariffs demanded of them, or should fail to publish the tariff fixed in the legal manner. Should the minister decide in such cases that the introduction of a new tariff or any changes in the actual one are required in the interests of the public, trade, industry, or of the State, then the computation of such a tariff devolves upon the department of railway affairs. The tariff committee then ratifies these tariffs and the conditions under which they shall be applied in due legal order, and the minister presents them to the senate to be published in the collection of Government decrees and orders. The tariffs compiled and published in this manner are obligatory both for the railway lines and the individuals who make use of them.

Such are the organization and powers of the tariff institutions established in 1889 in connection with the ministry of finance with the view of reforming the tariff department of the Russian railway lines, of introducing order and system into this branch of railway business and constantly watching that the scale of railway rates is consistent with the interests of all parties concerned. All measures taken up to the present time by the tariff institutions may be divided into two groups. One category of these measures is marked by what may be termed an organizing character, and is destined to put the matter under such conditions as would insure its regular progress and enable the Government to exercise the requisite control and supervision over railway tariffs.

Among other measures of this kind may be mentioned the organization of certain auxiliary agents, such as the publication of the Tariff Magazine, a statistical section of the general meetings of the railroad representatives, etc., and the fixing of some general rules which shall determine the various branches of business connected with railway rates.

The other sphere of action of the Government tariff institutions was directed toward the direct solution of those problems dealing with the regulation of tariffs, supervising them and directing the actions of the railway companies in this business. First comes the work of revising and regulating the tariffs of separate lines and groups of railways, and in simplifying and assimilating the rates for the most important goods over the entire network of Russian railways. Besides this, of course, current business concerning tariffs is transacted, and a sharp lookout is kept that the acting tariffs are carefully observed. The conditions of national economy are carefully studied, also the movements of freights and passengers, and other such questions of first importance in dealing with railway tariffs.

One of the first administrative measures taken by the ministry of finance was the issuing of rules referring to the composition, publication, introduction, and alteration of rates. The duties of the railways toward the State, and toward the public, are set forth with such fullness and exactitude that the railways have no possibility of evading the Government control or acting arbitrarily toward the public.

The timely publication of a tariff for general information is absolutely necessary for its being enforced. This publication must be made in a special periodical, called the "Magazine of Russian Railway Tariff," which is published twice a week. Up to January 1, 1893, it was published by the general association of railway representatives, but after this date it is published by the department of railway affairs.

Measures were then taken for the regular basing of railroad tariff statistics, and for periodically presenting data of that kind to the ministry of finance. For this purpose a special statistical section was organized at the general association of railroad representatives, and exact rules were taught for compiling, publishing, and presenting statistics referring to the conveyance of passengers and goods. By these rules the railway company is bound to keep, (1) complete statistics of the conveyances and receipts of passenger, troups, and goods traffic; (2) to record the statistics of the transport of goods according to a special nomenclature, so as to be enabled to give in good time all necessary information for working out rates.

It has already been stated that the competition between different railroads was one of the principal causes of the disorder and disagreement in railway rates. In order to avoid this, the tariff institutions compiled general bases, which were confirmed by the council and issued in the form of special rules made obligatory and introduced on all railroads from March 16, 1890. These regulations comprised the following: (*a*) The institution in various directions of equal or corresponding tariffs; (*b*) a corresponding distribution of freights in one or another direction; (*c*) a corresponding distribution between competing lines of the direction and receipts for conveying goods in one or another direction. The extent and order of the application of these rules must be determined from the united conditions of transport in one or another direction and should correspond to the degree of efficiency of each separate direction in actually accomplishing the transport, taking into consideration the extent of the competing directions and the advantages of transporting goods by them which might accrue to the interest of the public, industry, trade, and the State, and also the relation between the quantity of conveyances and number of managements and the distribution of lines over these directions.

In the absence of Government control over the tariffs, the railway economy suffered, amongst other things, from an irregular and unjustly founded distribution of charges for conveying goods by direct communication between separate lines. Some railways, taking advantage of their geographical position, advanced most unjust, pretentious, and exaggerated demands concerning their share of the general receipts for direct transportation. This question engrossed the attenton of the tariff institutions as soon as they commenced operations. The rules issued in 1889 were, however, superseded by new ones in 1891, which determined that the share of each line should be proportional to the distance the freight had traveled along it.

These departures from the general principles of the distribution of rates in proportion to the distances the goods were conveyed were only temporarily admitted, because it did not seem advisable at once to alter the former distribution system completely in accordance with the general principles before stated.

In April, 1893, new regulations were issued, abolishing the premium of short-distance lines and only reserving it for those lines from which wheat and coal freights were dispatched.

Whilst revising the so-called import tariffs upon foreign merchandise the tariff of the Nicolas Railway was taken as a basis, and when these were set the tariffs of other railway communications and also entire railway regions were regulated.

This was one of the first matters taken in hand by the tariff institutions. The former tariff, introduced as early as 1864, already ceased to correspond with the new conditions and elicited many complaints. It essentially differed from those of the other lines. The nomenclature did not at all coincide with that established by the ministry of ways and means of communication and used on other lines. The unsatisfactory classification of goods led to great difficulties when it came to taxing goods not mentioned in it, and there were many complaints that goods had been accidentally put down to one class or another without sufficient consideration to the conditions of trade and commerce. The scheme of this tariff was quite different from that upon which those of the other lines were based: The goods were divided into eight classes, from 50 to 15 kopecks per pood, for the whole distance between St. Petersburg and Moscow, and the carriage for the intermediate stations was calculated by a very complicated formula.

The necessity of revising the old tariff of the Nicolas Railway became more urgent on account of the particular importance of this line as uniting the two capitals of the Empire, and also from the fact that the direction from St. Petersburg to Moscow is the shortest route for conveying foreign goods to the Moscow market; the new tariff ought, therefore, to serve as a basis for regulating all import rates to Moscow through the other Baltic ports and western frontier stations. The principal bases elaborated by the tariff committee were: First, in order to facilitate the delivery of articles of consumption, such as dairy products, meat, fish, salt, vegetables, etc., it was necessary to endeavor to lower the rates for the conveyance of such articles from the stations in the interior to the centers where they are consumed. Next, with the view of making the line pay better, it was deemed advisable to raise the tariffs on more costly goods both of Russian and foreign extraction. Finally, in order to bring the Nicolas Railway tariff into the same shape as the others it was determined that the nomenclature and tariff scheme adopted in the new form should be the same as generally used upon all lines, expressed in simple fractions with known percentage of discount from the schedule rate for increased distance of transport.

Although the quantity of foreign goods imported into Russia is considerably less than the shipment of Russian goods abroad, it is nevertheless very large. The total value of the foreign goods imported in 1899 amounted to $306,116,000; in 1908 it rose to $384,863,105, while the exports for the corresponding years were $309,824,000 and $483,057,640, respectively, the total trade thus showing an increase of nearly 41 per cent.

Naturally all foreign goods which arrive at the ports are not sent on by rail; part of them are consumed in large seaport centers like St. Petersburg, Odessa, and Riga, and part are conveyed to the interior by water. Therefore the just solution of the question of import tariffs on these goods is of great importance to Russian industry in general.

## I. Coal Rates.

On all the Russian railroads, whether owned by the Government or by private corporations, there exists one classified tariff which is applied either per pood and verst (36.12 pounds and two-thirds mile), or per carload of 610, 750, and 900 poods, except as hereinafter stated.

Coal is divided into two classes, as follows: First class: Anthracite, pit coal, coal briquettes, coke, coke and coal slack. Second class: Peat, peat briquettes, and peat coke.

The following rates, calculated per carload, are charged for coal of the first class:

| Distances. | Rate. |
|---|---|
| 1 to 25 versts (0.663 to 16.57 miles). | $\frac{1}{30}$ kopeck per pood and verst (1.41 cents per ton-mile). |
| 26 to 157 versts (17.24 to 104.09 miles). | 0.83 kopeck (4.3 mills) per pood (36.12 pounds), plus $\frac{1}{65}$ kopeck per pood and verst (7.68 mills per ton-mile). |
| 158 to 203 versts (104.75 to 134.59 miles). | 3.23 kopecks (1.66 cents) per pood, plus $\frac{1}{60}$ kopeck per pood and verst (7.04 mills per ton-mile). |
| 204 to 498 versts (135.25 to 330.17 miles). | 4 kopecks (2.1 cents) per pood, plus $\frac{1}{81}$ kopeck per pood and verst (5.2 mills per ton-mile). |
| 499 to 580 versts (330.84 to 384.54 miles). | 7.64 kopecks (3.93 cents) per pood, plus $\frac{1}{150}$ kopeck per pood and verst (2.8 mills per ton-mile). |
| 581 to 890 versts (385.20 to 590.07 miles). | 8.05 kopecks (4.14 cents) per pood, plus $\frac{1}{270}$ kopeck per pood and verst (1.53 mills per ton-mile). |
| 891 to 1,257 versts (590.73 to 833.39 miles). | 9.25 kopecks (4.76 cents) per pood, plus $\frac{1}{300}$ kopeck per pood and verst (1.4 mills per ton-mile). |
| Over 1,257 versts | $\frac{1}{120}$ kopeck per pood and verst (3.5 mills per ton-mile). |

N. B.—The additional charges are frequently changed, depending upon local circumstances and the discretion of the respective authorities.

The following are the rates per carload for coal of the second class:

| Distances. | Rate. |
|---|---|
| 1 to 71 versts (0.663 to 47.07 miles). | $\frac{1}{65}$ kopeck per pood and verst (5 mills per ton-mile). |
| 72 to 300 versts (47.74 to 198.90 miles). | 1.09 kopecks per pood (5.6 mills per 36.12 pounds), plus $\frac{1}{150}$ kopeck per pood and verst (3.5 mills per ton-mile). |
| 301 to 491 versts (48.40 to 325.53 miles). | 3 kopecks (1.5 cents) per pood plus $\frac{1}{175}$ kopeck per pood and verst (2.4 mills per ton-mile), |
| Over 491 versts | $\frac{1}{120}$ kopeck per pood and verst (3.5 mills per ton-mile). |

The per pood rate on coal of the first class is one-twenty-fourth kopeck per pood and verst (1.76 cents per ton-mile), and on coal of the second class one-forty-fifth kopeck per pood and verst (9.4 mills per ton-mile).

RATES ON COAL SHIPPED IN CARLOADS BY SLOW FREIGHT.

| Termini. | Distance. | | Rate per pood. | | Equivalent per ton. |
|---|---|---|---|---|---|
| | Versts. | Equivalent in miles. | Kopecks. | Equivalent in cents. | |
| Almasnaya–Kharkov | 313 | 207.52 | 5.36 | 2.76 | $1.53 |
| Loskutovka–Kiev | 702 | 465.43 | 8.57 | 4.41 | 2.44 |
| Debaltzevo–Moscow | 1,019 | 676.6 | 9.68 | 4.98 | 2.76 |
| Millerovo–Tcheliabinsk | 2,147 | 1,423.46 | 17.89 | 9.2 | 5.09 |
| Tcheptza–Kharkov | 3,105 | 1,958.62 | 25.88 | 13.33 | 7.38 |

PEAT SHIPPED IN CARLOADS BY SLOW FREIGHT.

| | | | | | |
|---|---|---|---|---|---|
| Kulitzkaya–Moscow | 176 | 116.69 | 1.97 | 1.01 | $0.56 |
| Lakhva–Warsaw | 431 | 285.75 | 3.75 | 1.93 | 1.07 |
| Snitovo–Kasan | 1,998 | 1,324.67 | 16.65 | 8.57 | 4.75 |
| Burmakino–St. Petersburg | 689 | 456.81 | 5.75 | 2.96 | 1.64 |
| Suslovo–Nijni Novgorod | 3,401 | 2,254.86 | 28.35 | 14.6 | 8.08 |

(*e*) The class of rate into which coal traffic falls is a special one.

(*f*) The carload rate is charged on the full carrying capacity of the cars, which is 900 poods (16.24 tons), for coal and peat, though there are special cars for the transportation of coal, such as cars of the Holtenau and Kushmann system, with a carrying capacity of

1,500 poods (27.08 tons) of first-class coal and 1,000 poods (18.5 tons) of coke and slack, the Foxarbel cars carrying 1,900 poods (34.3 tons) of coke or slack. No difference exists in the rate for car or trainloads nor for shipments in closed cars or on platform cars.

(*g*) None of these rates have been given to encourage the industry.

## II. Rates on Iron Ore, Stone, Lumber, Fertilizer, and Grain.

### RATES CHARGED ON IRON ORE SHIPPED IN CARLOADS.

| Distances. | Rate. |
|---|---|
| 1 to 75 versts (0.663 to 49.73 miles) | $\frac{1}{75}$ kopeck per pood and verst (5.63 mills per ton-mile). |
| 76 to 172 versts (50.39 to 114.04 miles) | 1 kopeck (5 mills) per pood plus $\frac{1}{80}$ kopeck per pood and verst (5.28 mills per ton-mile). |
| 173 to 1,000 versts (114.7 to 666.3 miles) | 2.21 kopecks (1.14 cents) per pood plus $\frac{1}{135}$ kopeck per pood and verst (3.38 mills per ton-mile). |
| 1 001 to 1,622 versts (666.96 to 975.39 miles) | 8.83 kopecks (4.55 cents) per pood plus $\frac{1}{340}$ kopeck per pood and verst (2.8 mills per ton-mile). |
| ver 1,622 versts | $\frac{1}{1215}$ kopeck per pood and verst (3.38 mills per ton-mile). |

### PER POOD RATE (LESS THAN CARLOAD) ON IRON ORE.

| | |
|---|---|
| 1 to 200 versts (0.663 to 132.6 miles) | $\frac{1}{75}$ kopeck per pood and verst (9.4 mills per ton-mile). |
| 201 to 400 versts (133.26 to 265.2 miles) | 4.44 kopecks (2.28 cents) per pood plus $\frac{1}{65}$ kopeck per pood and verst (7.68 mills per ton-mile). |
| 401 to 900 versts (265.86 to 596.7 miles) | 8.08 kopecks (4.16 cents) per pood plus $\frac{1}{87}$ kopeck per pood and verst (7.6 mills per ton-mile). |
| 901 to 1,600 versts (597.36 to 1,060.8 miles) | 16.85 kopecks (8.68 cents) per pood plus $\frac{1}{65}$ kopeck per pood and verst (6.5 mills per ton-mile). |
| 1,601 to 2,759 versts (1,061.46 to 1,829.22 miles) | 27.95 kopecks (14.39 cents) per pood plus $\frac{1}{80}$ kopeck per pood and verst (5.28 mills per ton-mile). |
| Over 2,759 versts | $\frac{1}{65}$ kopeck per pood and verst (6.5 mills per ton-mile). |

### RATE ON IRON, BAR, PLATE, ROD, AND SHEET.

| | |
|---|---|
| 1 to 180 versts (0.663 to 119.34 miles) | $\frac{1}{75}$ kopeck per pood and verst (2.81 cents per ton-mile). |
| 181 to 450 versts (120 to 298.35 miles) | 12 kopecks per pood (6.18 cents per 36.12 pounds) plus $\frac{1}{75}$ kopeck per pood and verst (2.35 cents per ton-mile). |
| 451 to 900 versts (299 to 596.7 miles) | 27 kopecks (13.90 cents) per pood plus $\frac{1}{70}$ kopeck per pood and verst (1.05 cents per ton-mile). |
| 901 to 3,044 versts (597.36 to 2,017.17 miles) | 38.25 kopecks (19.70 cents) per pood plus $\frac{1}{100}$ kopeck per pood and verst (4.22 mills per ton-mile). |
| Over 3,044 versts | $\frac{1}{61}$ kopeck per pood and verst (8.28 mills per ton-mile). |

The carload rate for iron ore, bar, plate, rod, and sheet iron is charged for 900 poods (16.24 tons).

### RATES ON IRON ORE SHIPPED IN CARLOADS BY SLOW FREIGHT.

| Termini. | Distance. | | Rate per pood. | | Equivalent per ton. |
|---|---|---|---|---|---|
| | Versts. | Equivalent in miles. | Kopecks. | Equivalent in cents. | |
| Golotvin–Moscow | 10 | 6.63 | 1.43 | 0.74 | $0.41 |
| Orel–Kiev | 583 | 386.53 | 5.50 | 2.83 | 1.57 |
| Kopy–Tcheliabinsk | 707 | 515.62 | 6.49 | 3.34 | 1.85 |
| Pashiya–St. Petersburg | 1,790 | 1,186.77 | 14.32 | 7.37 | 4.08 |
| Ekaterinburg–Odessa | 3,266 | 2,165.36 | 26.13 | 13.46 | 7.45 |

### IRON ORE SHIPPED IN LESS THAN CARLOADS.

| | | | | | |
|---|---|---|---|---|---|
| Supsa–Batum | 52 | 34.48 | 1.16 | 0.6 | $0.33 |
| Sharopa–Baladjary | 670 | 444.21 | 12.82 | 6.6 | 3.65 |
| Lom–Revel | 901 | 597.36 | 16.87 | 8.69 | 4.81 |
| Kursk–Warsaw | 1,324 | 877.81 | 23.58 | 12.14 | 7.42 |
| Yaiva–Kharkov | 2,941 | 1,949.88 | 45.25 | 23.3 | 12.09 |

## 2. Stone.

### CARLOAD RATES ON STONE (ORDINARY BRICKS).

| Distances. | Rate. |
|---|---|
| 1 to 20 versts (0.663 to 13.26 miles).. | $\frac{1}{15}$ kopeck per pood and verst (9.4 mills per ton-mile). |
| 21 to 100 versts (13.92 to 66.3 miles).. | 0.44 kopecks (2.27 cents) per pood, plus $\frac{1}{75}$ kopeck per pood and verst (5.63 mills per ton-mile). |
| 101 to 250 versts (66.96 to 165.75 miles). | 1.50 kopecks (7.72 mills) per pood, plus $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |
| 251 to 400 versts (166.71 to 265.2 miles). | 3 kopecks (1.54 cents) per pood, plus $\frac{1}{150}$ kopeck per pood and verst (2.8 mills per ton-mile). |
| Over 400 versts..... | $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |

### CARLOAD RATES ON FIREPROOF BRICKS.

| | |
|---|---|
| 1 to 50 versts (0.663 to 33.15 miles)... | $\frac{1}{90}$ kopeck per pood and verst (11.1 mills per ton-mile). |
| 51 to 200 versts (33.81 to 132.6 miles). | 1.89 kopecks (9.73 mills) per pood, plus $\frac{1}{80}$ kopeck per pood and verst (7 mills per ton-mile). |
| 201 to 567 versts (133.26 to 375.86 miles). | 3.89 kopecks (2 cents) per pood, plus $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |
| Over 567 versts..... | $\frac{1}{75}$ kopeck per pood and verst (5.63 mills per ton mile). |

### PER POOD RATE ON STONES.

| | |
|---|---|
| 1 to 200 versts (0.663 to 132.6 miles).. | $\frac{1}{85}$ kopeck per pood and verst (11.7 mills per ton-mile). |
| 201 to 400 versts (133.26 to 265.2 miles). | 5.56 kopecks (2.6 cents) per pood, plus $\frac{1}{45}$ kopeck per pood and verst (9.4 mills per ton-mile). |
| 401 to 900 versts (265.86 to 596.7 miles). | 10 kopecks (5.15 cents) per pood, plus $\frac{1}{45}$ kopeck per pood and verst (9.19 mills per ton-mile). |
| 901 to 1,600 versts (597.36 to 1,060.8 miles). | 20.87 kopecks (10.75 cents) per pood, plus $\frac{1}{50}$ kopeck per pood and verst (8.45 mills per ton-mile). |
| 1,601 to 2,536 versts (1,061.46 to 1,681.37 miles). | 34.87 kopecks (17.96 cents) per pood, plus $\frac{1}{63}$ kopeck per pood and verst (6.7 mills per ton-mile). |
| Over 2,536 versts..... | $\frac{1}{57}$ kopeck per pood and verst (8.28 mills per ton-mile). |

### RATES ON ORDINARY BRICKS SHIPPED IN CARLOADS BY SLOW FREIGHT.

| Termini. | Distance. | | Rate per pood. | | Equivalent per ton. |
|---|---|---|---|---|---|
| | Versts. | Equivalent in miles. | Kopecks. | Equivalent in cents. | |
| Mojaisk–Moscow | 103 | 68.29 | 1.53 | 0.79 | $0.43 |
| Podolsk–Yaroslav | 336 | 222.77 | 3.57 | 1.84 | 1.02 |
| Viasma–Riga | 752 | 498.58 | 7.52 | 3.87 | 2.09 |
| Borisov–Mariupol | 1,317 | 873.17 | 13.17 | 6.78 | 3.75 |
| Skuratov–Arkhangelsk | 1,349 | 884.39 | 13.49 | 6.95 | 3.85 |

### PER POOD RATE ON ORDINARY BRICKS.

| | | | | | |
|---|---|---|---|---|---|
| Orel–Kharkov | 375 | 248.62 | 9.45 | 4.87 | $2.70 |
| Olenino St. Petersburg | 592 | 392.50 | 14.15 | 7.29 | 4.04 |
| Ranenburg–Kiev | 831 | 550.95 | 19.37 | 10.03 | 5.55 |
| Gagarino–Warsaw | 1,375 | 911.62 | 30.37 | 15.64 | 8.66 |

The carload rate on stones is charged for 900 poods (16.24 short tons).

## 3. Lumber.

RATE PER POOD ON LUMBER.

| Distances. | Rate. |
|---|---|
| 1 to 200 versts (0.663 to 132.6 miles).. | $\frac{1}{14}$ kopeck per pood and verst (1.76 cents per ton-mile). |
| 201 to 400 versts (133.26 to 265.2 miles). | 8.33 kopecks (4.29 cents) per pood plus $\frac{1}{28}$ kopeck per pood and verst (1.51 cents per ton-mile). |
| 401 to 900 versts (270.34 to 596.7 miles). | 15.47 kopecks (7.97 cents) per pood plus $\frac{1}{50}$ kopeck per pood and verst (1.41 cents per ton-mile). |
| 901 to 1,600 versts (597.36 to 1,060.8 miles). | 32.14 kopecks (16.35 cents) per pood plus $\frac{1}{95}$ kopeck per pood and verst (1.21 cents per ton-mile). |
| 1,601 to 2,000 versts (1,067.43 to 1,326 miles). | 51.58 kopecks (26.56 cents) per pood plus $\frac{1}{97}$ kopeck per pood and verst (1.06 cents per ton-mile). |
| 2,001 to 3,190 versts (1,392.3 to 2,114.97 miles). | 61.58 kopecks (31.71 cents) per pood plus $\frac{1}{75}$ kopeck per pood and verst (1.01 cents per ton-mile). |
| 3,191 to 4,723 versts (2,115.63 to 3,131.35 miles). | 89.91 kopecks (46.30 cents) per pood plus $\frac{1}{68}$ kopeck per pood and verst (0.62 cent per ton-mile). |
| Over 4,723 versts..... | $\frac{1}{72}$ kopeck per pood and verst (1.01 cents per ton-mile). |

Lumber shipped in carloads is divided into three classes, viz. (*a*) thin planks and timber, (*b*) sawed timber, (*c*) fuel wood and tailings.

CARLOAD RATES FOR CLASS A.

| Distances. | Rate. |
|---|---|
| 1 to 105 versts (0.663 to 69.61 miles).. | $\frac{1}{70}$ kopeck per pood and verst (1.41 cents per ton-mile). |
| 106 to 180 versts (70.28 to 119.34 miles). | 3.50 kopecks (1.80 cents) per pood plus $\frac{1}{80}$ kopeck per pood and verst (8.45 mills per ton-mile). |
| 181 to 300 versts (120 to 198.9 miles).. | 5 kopecks (2.57 cents) per pood plus $\frac{1}{60}$ kopeck per pood and verst (7 mills per ton-mile). |
| 301 to 400 versts (205.53 to 265.2 miles). | 7 kopecks (3.60 cents) per pood plus $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |
| 401 to 1,200 versts (271.85 to 795.6 miles). | 8 kopecks (4.12 cents) per pood plus $\frac{1}{300}$ kopeck per pood and verst (2.11 mills per ton-mile). |
| Over 1,200 versts..... | $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |

CARLOAD RATES FOR CLASS B.

| | |
|---|---|
| 1 to 90 versts (0.663 to 59.67 miles)... | $\frac{1}{90}$ kopeck per pood and verst (1.11 cents per ton-mile. |
| 91 to 190 versts (60.33 to 125.97 miles). | 2.50 kopecks (1.29 cents) per pood plus $\frac{1}{80}$ kopeck per pood and verst (8.45 mills per ton-mile). |
| 191 to 280 versts (126.93 to 185.64 miles). | 4.50 kopecks (2.32 cents) per pood plus $\frac{1}{60}$ kopeck per pood and verst (7 mills per ton-mile). |
| 281 to 360 versts (186.30 to 238.68 miles). | 6 kopecks (3.009 cents) per pood plus $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |
| 361 to 1,000 versts (239.34 to 663 miles). | 6.80 kopecks (3.50 cents) per pood plus $\frac{1}{300}$ kopeck per pood and verst (2.1 mills per ton-mile). |
| Over 1,000 versts..... | $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |

CARLOAD RATES FOR CLASS C.

| | |
|---|---|
| 1 to 30 versts (0.663 to 19.89 miles)... | $\frac{1}{70}$ kopeck per pood and verst (1.06 cents per ton-mile). |
| 31 to 310 versts (20.55 to 205.53 miles). | 0.75 kopeck (0.39 cent) per pood plus $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |
| 311 to 600 versts (206.19 to 397.8 miles). | 3.55 kopecks (1.83 cents) per pood plus $\frac{1}{300}$ kopeck per pood and verst (2.1 mills per ton-mile). |
| 601 to 1,200 versts (404.43 to 795.6 miles). | $\frac{1}{120}$ per pood and verst (3.5 mills per ton-mile). |
| 1,201 to 15,000 versts (802.23 to 994.5 miles). | 10 kopecks (5.15 cents) per pood plus $\frac{1}{150}$ kopeck per pood and verst (2.8 mills per ton-mile). |
| Over 15,000 versts.. | $\frac{1}{125}$ kopeck per pood and verst. |

CARLOAD RATES ON LUMBER OF CLASS A.

| Termini. | Distance. | | Rate per pood. | | Equivalent per ton. |
|---|---|---|---|---|---|
| | Versts. | Equivalent in miles. | Kopecks. | Equivalent in cents. | |
| Pinsk–Warsaw | 358 | 237.33 | 7.58 | 3.9 | $2.16 |
| Viatka–Rybinsk | 826 | 547.64 | 10.13 | 5.27 | 2.92 |
| Dobrush–Novorosisk | 1,473 | 976.60 | 14.73 | 7.59 | 4.20 |
| CLASS B. | | | | | |
| Dubrovka–Briansk | 78 | 51.71 | 2.17 | 1.44 | 0.80 |
| Selva–Praga | 277 | 183.65 | 5.95 | 3.06 | 1.69 |
| Kotlas–Moscow | 3,443 | 2,282.71 | 34.43 | 17.74 | 9.82 |
| CLASS C. | | | | | |
| Karatshev–Orel | 83 | 55 | 1.28 | 0.66 | 0.36 |
| Orsha–Mitau | 570 | 377.91 | 4.85 | 2.50 | 1.38 |
| Bogoyavlensk–Warsaw | 1,388 | 920.24 | 13.88 | 7.15 | 3.96 |
| PER POOD RATES ON LUMBER. | | | | | |
| Tuckum–Witebsk | 510 | 338.13 | 19.14 | 9.86 | 5.46 |
| Shlobin–Orel | 754 | 499.90 | 27.27 | 14.04 | 7.77 |
| Grodno–Odessa | 1,134 | 751.84 | 38.61 | 19.88 | 11.01 |

The carload rate on lumber is charged for 900 poods (16.24 tons).

## *4. Fertilizers.*

Per pood rate on fertilizers, $\frac{1}{65}$ kopeck per pood and verst.

CARLOAD RATES ON FERTILIZERS (GROUND BONE, BONE, BURNT AND CRUSHED SCORIA AND GROUND PHOSPHORITES).

| Distances. | Rate. |
|---|---|
| 1 to 113 versts (0.663 to 74.92 miles). | $\frac{1}{65}$ kopeck per pood and verst (6.5 mills per ton per mile). |
| 114 to 754 versts (75.58 to 499.90 miles). | 1.74 kopecks (0.9 cent) per pood plus $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |
| 755 to 1,314 versts (500.56 to 871.18 miles). | 8.15 kopecks (4.2 cents) per pood plus $\frac{3}{200}$ kopeck per pood and verst (2.1 mills per ton-mile). |
| 1,315 to 2,122 versts (871.84 to 1,396.87 miles). | $\frac{1}{120}$ kopeck per pood and verst (3.5 mills per ton-mile). |
| 2,123 to 2,650 versts (1,397.55 to 1,756.95 miles). | 17.68 kopecks (9.1 cents) per pood plus $\frac{1}{100}$ kopecks per pood and verst (2.8 mills per ton-mile). |
| Over 2,650 versts | $\frac{1}{125}$ kopeck per pood and verst (3.38 mills per ton-mile). |

CARLOAD RATES ON ALL OTHER FERTILIZERS.

| | |
|---|---|
| 1 to 113 versts (0.663 to 74.92 miles). | $\frac{1}{65}$ kopeck per pood and verst (6.5 mills per ton-mile). |
| 114 to 878 versts (75.58 to 5,821.14 miles). | 1.74 kopecks (0.9 cent) per pood plus $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |
| 879 to 2,650 versts (5,827.87 to 1,756.95 miles). | 9.39 kopecks (4.84 cents) per pood plus $\frac{1}{180}$ kopeck per pood and verst (2.8 mills per ton-mile). |
| Over 2,650 versts | $\frac{1}{125}$ kopeck per pood and verst (3.38 mills per ton-mile). |

CARLOAD RATES ON FERTILIZERS—PHOSPHORITES, ETC.

| Termini. | Distance. | | Rate per pood. | | Equivalent per ton. |
|---|---|---|---|---|---|
| | Versts. | Equivalent in miles. | Kopecks. | Equivalent in cents. | |
| Moscow–Saratov | 796 | 527.75 | 8.36 | 4.31 | $2.39 |
| Nijni–Novgorod–Nakhoi | 856 | 567.52 | 8.71 | 4.47 | 2.47 |
| Riga–Samara | 1,866 | 1,237.16 | 15.55 | 8 | 4.43 |
| Wirballen–Tomsk | 4,588 | 3,041.84 | 36.70 | 18.9 | 10.46 |

CARLOAD RATES ON FERTILIZERS—STASSFURT SALT, ETC.

| | | | | | |
|---|---|---|---|---|---|
| Siedlce–Warsaw | 84 | 55.69 | 0.66 | 0.66 | $0.37 |
| Smolensk–Kharkov | 738 | 489.29 | 7.99 | 4.11 | 2.82 |
| Libau–Tzaritzin | 1,959 | 1,298.82 | 16.60 | 8.55 | 4.73 |
| Alexandrovo–Petropavlovsk | 3,804 | 2,522.05 | 30.43 | 15.67 | 8.68 |

PER POOD RATE ON FERTILIZERS.

| | | | | | |
|---|---|---|---|---|---|
| Jeletz–Verkhovye | 98 | 50.47 | 1.51 | 0.78 | $0.43 |
| Woloczysk–Odessa | 510 | 338.13 | 7.85 | 4.04 | 2.24 |
| Grayevo–Groskurov | 852 | 564.88 | 13.11 | 6.75 | 3.74 |
| Sosnovici–Poltava | 1,242 | 823.45 | 19.11 | 9.84 | 5.45 |

The carload rate on fertilizers is charged for 610 poods (11 tons).

### *5. Cereals.*

The rates on cereals are divided into four classes, viz, (1) cereals in grain, (2) flour and ground products, (3) tailings, (4) oil seeds.

PER POOD RATES ON CEREALS.

| Distances. | Rate. |
|---|---|
| 1 to 200 versts (0.663 to 132.6 miles). | $\frac{3}{4}$ kopeck per pood and verst (1.76 cents per ton-mile. |
| 201 to 400 versts (133.26 to 265.2 miles). | 8.33 kopecks (4.29 cents) per pood plus $\frac{3}{5}$ kopeck per pood and verst (1.51 cents per ton-mile). |
| 401 to 900 versts (270.34 to 596.7 miles). | 15.47 kopecks (7.97 cents) per pood plus $\frac{3}{10}$ kopeck per pood and verst (1.41 cents per ton-mile). |
| 901 to 1,600 versts (597.36 to 1,060.8 miles). | 32.14 kopecks(16.35 cents)per pood plus $\frac{1}{3}$ kopeck per pood and verst (1.21 cents per ton-mile). |
| 1,601 to 2,000 versts (1,067.43 to 1,326 miles). | 52.58 kopecks (27.08 cents) per pood plus $\frac{2}{5}$ kopeck per pood and verst (1.06 cents per ton-mile). |
| 2,001 to 3,190 versts (1,392.3 to 2,114.97 miles). | 81.53 kopecks (41.99 cents) per pood plus $\frac{1}{4}$ kopeck per pood and verst (1.01 cents per ton-mile). |
| 3,191 to 4,723 versts (2,115.63 to 3,131.35 miles). | 89.91 kopecks (46.30 cents) per pood plus $\frac{1}{8}$ kopeck per pood and verst (0.62 cent per ton-mile). |
| Over 4,723 versts | $\frac{1}{4}$ kopeck per pood and verst (1.01 cents per ton-mile). |

The following rates per carload are charged on cereals shipped for export:

CEREALS OF CLASS 1 AND CLASS 3 (SCHEDULE A)—A.

| Distances. | Rate. |
|---|---|
| 1 to 180 versts (0.663 to 119.34 miles). | $\frac{1}{57}$ kopeck per pood and verst (1.74 cents per ton-mile). |
| 181 to 344 versts (120 to 228.07 miles). | 7.20 kopecks (3.71 cents) per pood plus $\frac{1}{63}$ kopeck per pood and verst (0.67 cent per ton-mile). |
| 345 to 800 versts (228.73 to 530.4 miles). | 9.80 kopecks (5.05cents) per pood plus $\frac{1}{68}$ kopeck per pood and verst (0.62 cent per ton-mile). |
| 801 to 1,120 versts (531.06 to 742.56 miles). | 16.50 kopecks (8.50 cents) per pood plus $\frac{1}{64}$ kopeck per pood and verst (0.51 cent per ton-mile). |
| 1,121 to 2,779 versts (743.22 to 1,842.48 miles). | 20.31 kopecks (10.46 cents) per pood plus $\frac{1}{113}$ kopeck per pood and verst (0.37 cent per ton-mile). |
| Over 2,779 versts | $\frac{1}{80}$ kopeck per pood and verst (0.53 cent per ton-mile). |

CEREALS OF CLASS 2 (SCHEDULE B).—B.

| | |
|---|---|
| 1 to 180 versts (0.663 to 119.34 miles). | $\frac{1}{57}$ kopeck per pood and verst (17.4 mills per ton-mile). |
| 181 to 600 versts (120 to 397.8 miles). | 7.20 kopecks (3.71 cents) per pood plus $\frac{1}{65}$ kopeck per pood and verst (7.68 mills per ton-mile). |
| 601 to 800 versts (398.46 to 530.4 miles). | 14.84 kopecks (7.64 cents) per pood plus $\frac{1}{60}$ kopeck per pood and verst (7 mills per ton-mile). |
| 801 to 956 versts (378.46 to 633.83 miles). | 18.17 kopecks (9.36 cents) per pood plus $\frac{1}{75}$ kopeck per pood and verst (5.6 mills per ton-mile) |
| 957 to 1120 versts (634.49 to 742.56 miles). | 20.25 kopecks (10.43 cents) per pood plus $\frac{1}{60}$ kopeck per pood and verst (5.3 mills per ton-mile). |
| 1,121 to 2,000 versts (743.22 to 1,326 miles). | 22.30 kopecks (11.48 cents) per pood plus $\frac{1}{104}$ kopeck per pood and verst (4.1 mills per ton-mile). |
| 2,001 to 2,672 versts (1,326.66 to 1,737.06 miles). | 30.76 kopecks (15.84 cents) per pood plus $\frac{1}{118}$ kopeck per pood and verst (3.7 mills per ton-mile). |
| Over 2,672 versts | $\frac{1}{78}$ kopeck per pood and verst (5.6 mills per ton-mile). |

CEREALS OF CLASS 4.

| | |
|---|---|
| 1 to 260 versts (0.663 to 172.38 miles). | $\frac{1}{57}$ kopeck per pood and verst (17.2 mills per ton-mile). |
| 261 to 344 versts (173.04 to 227.41) | 10.40 kopecks (5.36 cents) per pood plus $\frac{1}{63}$ kopeck per pood and verst (6.7 mills per ton-mile). |
| 345 to 800 versts (228.07 to 530.4 miles). | 11.73 kopecks (6.04 cents) per pood plus $\frac{1}{68}$ kopeck per pood and verst (6.2 mills per ton-mile). |
| 801 to 1,120 versts (531.06 to 742.56 miles). | 18.44 kopecks (9.50 cents) per pood plus $\frac{1}{64}$ kopeck per pood and verst (5.1 mills per ton-mile). |
| 1,121 to 2,698 versts (743.22 to 1,788.77 miles). | $\frac{1}{78}$ kopeck per pood and verst (5.63 mills per ton-mile). |

INLAND RATES PER CARLOAD ON CEREALS (EXCLUSIVE OF FLOUR AND GROATS).

| | |
|---|---|
| 1 to 200 versts (0.663 to 132.6 miles). | $\frac{1}{77}$ kopeck per pood and verst (12.6 mills per ton-mile). |
| 201 to 540 versts (133.26 to 358.02 miles). | 5.88 kopecks (3.03 cents) per pood plus $\frac{1}{50}$ kopeck per pood and verst (0.84 cent per ton-mile). |
| Over 540 versts according to schedule A. | |

INLAND RATES ON FLOUR AND GROATS.

| | |
|---|---|
| 1 to 200 versts (0.663 to 132.6 miles). | $\frac{1}{71}$ kopeck per pood and verst (14 mills per ton mile). |
| 201 to 422 versts (133.26 to 279.78 miles). | 6.48 kopecks (3.34 cents) per pood plus $\frac{1}{75}$ kopeck per pood and verst (9.4 mills per ton-mile). |
| 423 to 540 versts (280.45 to 358.02 miles). | 11.39 kopecks (5.87 cents) per pood plus $\frac{1}{50}$ kopeck per pood and verst (0.84 cent per ton-mile). |
| Over 540 versts according to schedule B. | |

INLAND RATES ON CEREALS OF THE THIRD CLASS.

| | |
|---|---|
| 1 to 1,058 versts (0.663 to 699.46 miles) | $\frac{1}{60}$ kopeck per pood and verst (0.7 cent per ton-mile). |
| Over 1,058 versts according to schedule A, less 10 per cent. | |

INLAND CARLOAD RATES ON CEREALS OF THE FIRST AND FOURTH CLASSES.

| Termini. | Distance. | | Rate per pood. | | Equivalent per ton. |
|---|---|---|---|---|---|
| | Versts. | Equivalent in miles. | Kopecks. | Equivalent in cents. | |
| Voronesh–Kiev | 668 | 442.88 | 14.56 | 7.5 | $4.15 |
| Tarasovka–Kharkov | 538 | 356.69 | 12.64 | 6.51 | 3.60 |
| Poltava–Warsaw | 1,050 | 696.15 | 19.48 | 10.03 | 5.55 |
| Orenburg–Yaroslavl | 1,665 | 1,103.89 | 25.05 | 12.9 | 7.14 |
| Tashkent–Moscow | 3,222 | 2,134.86 | 39.03 | 20.1 | 11.13 |

INLAND CARLOAD RATES ON CEREALS OF THE SECOND CLASS.

| | | | | | |
|---|---|---|---|---|---|
| Taiga–Nijni Novgorod | 3,240 | 2,148.12 | 44.38 | 22.86 | $12.66 |
| Pensa–Warsaw | 1,791 | 1,187.43 | 28.75 | 14.81 | 8.20 |
| Borissoglebsk–Moscow | 630 | 417.69 | 15.34 | 7.9 | 4.37 |
| Riashsk–Jeletz | 319 | 211.50 | 9.10 | 4.69 | 2.60 |
| Fersikovo–Kaluga | 41 | 27.18 | 1.32 | .68 | .38 |

INLAND CARLOAD RATES ON CEREALS OF THE THIRD CLASS.

| | | | | | |
|---|---|---|---|---|---|
| Safonovka–Paveletz | 159 | 105.42 | 2.65 | 1.36 | $0.75 |
| Kaluga–Volovo | 229 | 151.83 | 3.82 | 1.97 | 1.09 |
| Riazan–Kiev | 475 | 314.92 | 7.92 | 4.08 | 2.26 |
| Jeletz–Nijni Novgorod | 832 | 551.62 | 13.87 | 7.14 | 4.65 |
| Petropawlovsk–Kharkov | 2,694 | 1,789.12 | 30.60 | 15.76 | 8.73 |

## III. Special Export Rates.

Special rates granted to export business are as follows:

On coal shipped abroad and to Baltic ports, from all stations of the Ekaterin, Southeastern and Southern Railroads, viz:

| Distances. | Rate. |
|---|---|
| 1 to 56 versts (0.663 to 37.13 miles) | $\frac{1}{65}$ kopeck per pood and verst (6.5 mills per ton-mile). |
| 57 to 120 versts (37.79 to 79.56 miles) | 0.86 kopeck (0.44 cent) per pood, plus $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |
| 121 to 245 versts (80.22 to 162.43 miles) | 1.50 kopecks (0.77 cent) per pood, plus $\frac{1}{135}$ kopeck per pood and verst (3.38 mills per ton-mile). |
| 246 to 260 versts (163.20 to 172.38 miles) | 2.50 kopecks (1.29 cents) per pood, plus $\frac{1}{100}$ kopeck per pood and verst (2.8 mills per ton-mile). |
| 261 to 943 versts (173.04 to 625.21 miles) | $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |

On lumber of the first and second class, from all inland stations to the frontier stations of western Russia, viz, Eydtkuhnen, Prostken, Illovo, Skalmiercyze, Brody, Podvoloczyska, Mowoselitza, Ungheni, Alexandrovo, Sosnowic, Granica:

LUMBER OF THE FIRST CLASS.

| Distances. | Rate. |
|---|---|
| 1 to 45 versts (0.663 to 29.83 miles) | $\frac{1}{90}$ kopeck per pood and verst (11.7 mills per ton-mile). |
| 46 to 165 versts (30.50 to 109.39 miles) | 1.25 kopecks (6.44 cents) per pood plus $\frac{1}{80}$ kopeck per pood and verst (8.45 mills per ton-mile). |
| 166 to 280 versts (110.06 to 185.64 miles) | 3.65 kopecks (1.88 cents) per pood plus $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |
| 281 to 680 versts (186.30 to 350.84 miles) | 4.80 kopecks (2.47 cents) per pood plus $\frac{1}{200}$ kopeck per pood and verst (2.1 mills per ton-mile). |
| Over 680 versts | $\frac{1}{100}$ per pood and verst (4.2 mills per ton-mile). |

LUMBER OF THE SECOND CLASS.

| Distances. | Rate. |
|---|---|
| 1 to 60 versts (0.663 to 39.78 miles) | $\frac{1}{10}$ kopeck per pood and verst (10.7 mills per ton-mile). |
| 61 to 120 versts (40.44 to 79.54 miles) | 1.50 kopecks (7.72 cents) per pood plus $\frac{1}{60}$ kopeck per pood and verst (7 mills per ton-mile). |
| 121 to 300 versts (79.56 to 198.9 miles) | 2.50 kopecks (1.29 cents) per pood plus $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |
| 301 to 560 versts (199.56 to 371.28 miles) | 4.30 kopecks (22.14 cents) per pood plus $\frac{1}{200}$ kopeck per pood and verst (2.1 mills per ton-mile). |
| Over 560 versts | $\frac{1}{100}$ kopeck per pood and verst (4.2 mills per ton-mile). |

On cereals of the second class shipped to the Far East and Finland according to schedule B less 20 per cent.

Carload rates on cereals shipped to seaports and frontier stations are as follows:

(A) CEREALS OF THE FIRST CLASS.

| Termini. | Distance. | | Rate per pood. | | Equivalent per ton. |
|---|---|---|---|---|---|
| | Versts. | Equivalent in miles. | Kopecks. | Equivalent in cents. | |
| Kurshany–Libau | 135 | 89.50 | 5.40 | 2.78 | $1.54 |
| Voroshba–Wirballen | 925 | 613.27 | 17.99 | 9.26 | 5.13 |
| Samara–Riga | 1,866 | 1,237.16 | 26.80 | 13.8 | 7.64 |
| Saratov–Alexandrovo | 2,065 | 1,369.10 | 28.53 | 14.69 | 8.13 |
| Viasovaya–Windau | 2,700 | 1,790.1 | 34.05 | 17.54 | 9.71 |

(B) CEREALS OF THE SECOND CLASS.

| | | | | | |
|---|---|---|---|---|---|
| Shmerinka–Odessa | 364 | 241.33 | 10.55 | 5.43 | $3.01 |
| Bobrov–Rostoff-on-Don | 568 | 376.58 | 14.25 | 7.34 | 4.06 |
| Koslov–Libau | 1,365 | 904.97 | 24.66 | 12.7 | 7.03 |
| Volsk–Wirballen | 1,858 | 1,231.85 | 29.40 | 15.14 | 9.08 |
| Simbirsk–Sosnowice | 2,314 | 1,534.18 | 33.49 | 17.25 | 9.55 |

(C) CEREALS OF THE THIRD AND FOURTH CLASSES.

| | | | | | |
|---|---|---|---|---|---|
| Warsaw–Alexandrovo | 210 | 139.23 | 8.40 | 4.33 | $2.40 |
| Ranenburg–Mariupol | 914 | 605.98 | 19.80 | 10.2 | 5.65 |
| Voronesh–Novorosisk | 1,035 | 686.20 | 21.24 | 10.94 | 6.06 |
| Szezypivno–Voronesh | 1,623 | 1,076 | 26.62 | 13.71 | 7.59 |
| Omsk–Libau | 3,733 | 2,474.78 | 49.77 | 25.63 | 14.19 |

The rates for fast freight on all kinds of goods, with the exception of special rates granted on shipments of perishable goods, are as follows:

| Distances. | Rate. |
|---|---|
| 1 to 200 versts (0.663 to 132.6 miles) | $\frac{1}{4}$ kopeck per pood and verst (7.04 cents per ton-mile). |
| 201 to 410 versts (133.26 to 271.83 miles) | 33.33 kopecks (17.16 cents) per pood plus $\frac{1}{4}$ kopeck per pood and verst (6.03 cents per ton-mile). |
| 411 to 1,130 versts (272.49 to 749.19 miles) | 63.33 kopecks (32.61 cents) per pood plus $\frac{1}{8}$ kopeck per pood and verst (5.28 cents per ton-mile). |
| 1,131 to 2,000 versts (749.85 to 1,326 miles) | 153.33 kopecks (78.96 cents) per pood plus $\frac{1}{6}$ kopeck per pood and verst (4.7 cents per ton-mile). |
| 2,001 to 6,000 versts (1,326.66 to 3,978 miles) | 250 kopecks (128.75 cents) per pood plus $\frac{1}{10}$ kopeck per pood and verst (4.23 cents per ton-mile). |
| Over 6,000 versts | 650 kopecks (334.75 cents) per pood plus $\frac{1}{15}$ kopeck per pood and verst (2.81 cents per ton-mile). |

N. B.—It is impossible to give all the special rates, as they vary for the various kinds of perishable goods. There are, for instance, special rates on butter, eggs, cheese, meat, fruits, flowers, plants, and numerous other perishable goods.

In addition to the above freight rates, the following charges are made:

(*a*) Station charges: On all kinds of goods, shipped in less than carload lots, 0.70 kopeck per pood (3.6 mills per 36.12 pounds); coal in carloads, 0.40 kopeck per pood (2.06 mills per 36.12 pounds); iron ore in carloads, 0.40 kopeck per pood (2.06 mills per 36.12 pounds); bricks in carloads, 0.40 kopeck per pood (2.06 mills per 36.12 pounds); lumber in carloads, 0.40 kopeck per pood (2.06 mills per 36.12 pounds); fertilizers in carloads, 0.40 kopeck per pood (2.06 mills per 36.12 pounds); cereals in carloads, 0.50 kopeck per pood (2.57 mills per 36.12 pounds).

(*b*) Loading and unloading, 0.50 kopeck per pood (2.57 mills per 36.12 pounds).

(*c*) Weighing, 0.25 kopeck per pood (1.28 mills per 36.12 pounds); if the goods are shipped in bulk, 1 ruble per car.

(*d*) One-fifth kopeck per pood on all kinds of goods. This revenue is applied toward improvement of storing facilities of the various railroads.

## IV. Highest Grade of Classified Freight.

The highest grade of classified freight, that which corresponds to the express business in the United States, is carried by passenger trains, and the rate is made according to zones.

The length of these zones is as follows: From 300 to 500 versts, 8 zones, at 25 versts each; 501 to 710 versts, 7 zones, at 30 versts each; 711 to 990 versts, 8 zones, at 35 versts each; 991 to 1,510 versts, 13 zones, at 40 versts each; 1,511 to 3,010 versts, 30 zones, at 50 versts each; over 3,010 versts every zone is counted at 70 versts.

All kinds of goods, except as below mentioned, fall under the zone tariff No. 1.

Zone tariff No. 2: Dry yeast, Russian Black Sea oysters, fresh meat, sausages, poultry, live fish, frozen fish, crawfish, oranges, pineapples, lemons, olives, nuts, fresh berries, and fruits not specified above or in tariff No. 5.

Zone tariff No. 3: Russian beer and porter.

Zone tariff No. 4: Plants, shrubs, and trees.

Zone tariff No. 5: Newspapers, magazines, books, oak leaves, butter, cheese, melons, green cabbage, potatoes, beans, peas, onions, other green vegetables, fresh fruit not mentioned in tariff No. 2, such as apricots, grapes, pears, plums, apples, strawberries, etc.

Zone tariff No. 6: Milk and cream.

*Zone tariff No. 1.*

1 of 300 versts (0.663 to 198.9 miles), 0.0575 kopeck (0.03 mill) per verst and 10 pounds.

301 to 325 versts (199.56 to 215.47 miles), 17.25 kopecks (8.88 cents) for the entire distance and 10 pounds.

326 versts (216.14 miles) and over, 17.25 kopecks (8.88 cents) for 325 versts and 10 pounds, plus 1.5 kopecks (7.7 mills) for each zone and 10 pounds.

*Zone tariff No. 2.*

1 to 8 versts (0.663 to 5.3 miles), 0.0575 kopecks (0.03 mill) per verst and 10 pounds.
9 to 31 versts (5.97 to 20.55 miles), 0.46 kopeck (2.37 mills) per 8 versts and 10 pounds plus one-fortieth kopeck (0.13 mill) per verst and 10 pounds.
32 to 300 versts (21.22 to 198.9 miles), one-thirtieth kopeck (0.17 mill) per verst and 10 pounds.
301 to 3,010 versts (199.56 to 1,995.6 miles), 10 kopecks (5.1 cents) per 300 versts (198.9 miles) and 10 pounds, plus 0.7 kopeck (3.6 mills) for each zone and 10 pounds.
Over 3,011 versts, 56.2 kopecks (28.94 cents), plus 1 kopeck for each zone and 10 pounds.

*Zone tariff No. 3.*

1 to 10 versts (0.663 to 6.63 miles), 0.0575 kopeck (0.03 mill) per verst and 10 pounds.
11 to 31 versts (7.29 to 20.55 miles), 0.58 kopeck (2.98 mills), plus one one-hundredth kopeck (0.05 mill) per verst and 10 pounds.
32 to 300 versts (21.22 to 198.9 miles), one-fortieth kopeck (0.13 mill) per verst and 10 pounds.
301 to 3,010 versts (199.56 to 1,995.6 miles), 7.5 kopecks (4.97 cents) per 10 pounds, plus 0.5 kopeck (2.57 mills) for each zone and 10 pounds.
Over 3,010 versts, 40.5 kopecks (26.85 cents) per 10 pounds, plus 0.7 kopeck 3.6 mills) for each zone and 10 pounds.

*Zone tariff No. 4.*

1 to 10 versts (0.663 to 6.63 miles), one-twentieth kopeck (0.26 mill) per verst and 10 pounds.
11 to 41 versts (7.29 to 20.55 miles), 0.5 kopeck (2.57 mills) per 10 pounds, plus one one-hundredth kopeck per verst and 10 pounds.
42 to 300 versts (21.22 to 198.9 miles), one-fiftieth kopeck (0.1 mill) per verst and 10 pounds.
301 to 3,010 versts (199.56 to 1,995.6 miles), 6 kopecks (2.57 cents) per 10 pounds, plus 0.5 kopeck (2.57 mills) for each zone and 10 pounds.
Over 3,010 versts, 39 kopecks (20 cents) per 10 pounds, plus 0.7 kopeck (3.6 mills) for each zone and 10 pounds.

*Zone tariff No. 5.*

1 to 20 versts (6.63 to 13.26 miles), one-thirtieth kopeck (0.17 mill) per verst and 10 pounds.
21 to 77 versts (13.92 to 50.45 miles), 0.67 kopeck (3.45 mills) per 10 pounds, plus one forty-fifth kopeck (0.11 mill) per verst and 10 pounds.
78 to 300 versts (51.11 to 198.9 miles), one-fortieth kopeck (0.13 mill) per verst and 10 pounds.
301 to 3,010 versts (199.56 to 1995.6 miles), 7.5 kopecks (3.86 cents) per 10 pounds, plus 0.3 kopeck (1.5 mills) for each zone and 10 pounds.
Over 3,010 versts, 27.3 kopecks (14.06 cents) per 10 pounds, plus 0.4 kopeck (2 mills) for each zone and 10 pounds.

*Zone tariff No. 6.*

1 to 300 versts (0.663 to 198.9 miles), one-eightieth kopeck (0.65 mill) per verst and 10 pounds.
301 to 620 versts (199.56 to 411 miles), 3.75 kopecks (1.93 cents) per 10 pounds, plus 0.4 kopeck (2 mills) for each zone and 10 pounds.
621 to 650 versts (411.72 to 430.95 miles), 8.90 kopecks (4.58 cents) per 10 pounds for the entire distance.
651 to 3,010 versts (431.61 to 1,995.6 miles), 8.90 kopecks (4.58 cents) per 10 pounds, plus 0.3 kopeck (1.5 mills) for each zone and 10 pounds.
Over 3,010 versts, 24.80 kopecks (12.77 cents) per 10 pounds, plus 0.4 kopeck (2 mills) for each zone and 10 pounds.

(5 and 6) Answered in paragraphs 1, 2, and 3.

## RAILWAY RATES IN EASTERN SIBERIA.

The railway rates in eastern Siberia differ from those in European Russia. The Chinese Eastern Railway and the Ussuri Railway, though both are owned by the Russian Government, have separate freight schedules which are divided into various classes.

### I. Coal Rates.

(*a*, *b*, *c*) Chinese Eastern Railway: Pogranitchnaya to Manchuria, 1,388 versts (920.24 miles), maximum distance; transportation charge, 30 kopecks (15.45 cents) per pood (36.12 pounds); terminal charge, 0.0084 kopeck (0.043 mill) per pood in carload lots and 0.0184 kopeck (0.095 mill) per pood in less than carload lots.

Ussuri Railway: Vladivostok to Habarovsk, 716 versts (474.71 miles), maximum distance; transportation charge, 9 kopecks (4.6 cents) per pood; terminal charge, 0.0084 kopeck (0.043 mill) per pood in carload lots and 0.0184 kopeck (0.095 mill) per pood in less than carload lots.

Chinese Eastern & Ussuri Railways: Harbin to Habarovsk, 1,246 versts (826.10 miles), maximum distance; transportation charge, 0.1737 kopeck (0.89 mill) per pood in carload lots, 0.5247 kopeck (2.7 mills) per pood in less than carload lots; terminal charge, 0.0084 kopeck per pood in carload lots and 0.0184 kopeck per pood in less than carloads.

(*d*) The terminal charges include station expenses, loading, and unloading.

(*e*) The above rates are normal class rates.

(*f*) Additional charges are made for fast freight, and the rate is higher when less than one carload is shipped, but no difference is made in the rate for more than one carload.

(*g*) The above are published rates, but special rates are occasionally granted in order to transport coal from different mines. These special rates as they are granted are published in a weekly publication issued by the railroad department at St. Peterburg.

### II. Rates on Iron Ore, Stone, Lumber, Fertilizer, and Grain.

#### *1. Iron ore.*

Chinese Eastern Railway: Pogranitchnaya to Manchuria, 1,388 versts (920.24 miles), maximum distance; transportation charge, 29 kopecks (14.93 cents) per pood; terminal charge, 0.0084 kopeck per pood in carload lots and 0.0184 kopeck per pood in less than carloads.

Ussuri Railway: Vladivostok to Habarovsk, 716 versts (474.71 miles), maximum distance; transportation charge, 8 kopecks (4.12 cents) per pood; terminal charge, 0.0084 kopeck per pood in carload lots and 0.0184 kopeck per pood in less than carloads.

Chinese Eastern & Ussuri Railways: Harbin to Habarovsk, 1,246 versts (826.10 miles), maximum distance; transportation charge, 0.1707 kopeck (0.88 mill) per pood for carload lots and 0.3987 kopeck (2.05 mills) per pood for less than carload lots. The terminal

charge is 0.0084 kopeck per pood in carload lots and 0.0184 kopeck in less than carloads.

(*d*) The terminal charges include station expenses, loading, and unloading.

(*e*) The rate is a normal class rate.

(*f*) Additional charges are made for fast freight, and the rate is higher when less than one carload is shipped, but no difference is made in the rate for more than one carload.

### *2. Stone.*

(*a*, *b*, *c*) Chinese Eastern Railway: Pogranitchnaya to Manchuria, 1,388 versts (920.24 miles), maximum distance; transportation charge, 24 kopecks (12.36 cents) per pood; terminal charge, 0.007 kopeck (0.036 mill) per pood in carload lots and 0.0184 kopeck (0.095 mill) per pood in less than carloads.

Ussuri Railway: Vladivostok to Habarovsk, 716 versts (474.71 miles), maximum distance; transportation charge, 7 kopecks (3.6 cents) per pood; terminal charge, 0.007 kopeck (0.036 mill) per pood in carload lots and 0.0184 kopeck (0.095 mill) per pood in less than carloads.

Chinese Eastern & Ussuri Railways: Harbin to Habarovsk, 1,246 versts (826.10 miles), maximum distance; transportation charge, 16 kopecks (8.24 cents) per pood in carload lots and 0.4317 kopeck (2.22 mills) per pood in less than in carloads; terminal charge, 0.007 kopeck (0.036 mill) per pood in carload lots and 0.0184 kopeck (0.095 mill) per pood in less than carloads.

(*d*) The terminal charges include station expenses, loading, and unloading.

(*e*) The rate is a normal class rate.

(*f*) Additional charges are made for fast freight, and the rate is higher when less than one carload is shipped, but no difference is made in the rate for more than one carload.

### *3. Lumber.*

(*a*, *b*, *c*) Chinese Eastern Railway: Pogranitchnaya to Manchuria, 1,388 versts (920.24 miles) maximum distance; transportation charge, 28 kopecks (14.42 cents) per pood; terminal charge, 0.0084 kopeck (0.043 mill) per pood in carload lots and 0.0184 kopeck per pood in less than carloads.

Ussuri Railway: Vladivostok to Habarovsk, 716 versts (474.71 miles) maximum distance; transportation charge, 16½ kopecks (8.3 cents) per pood; terminal charge, 0.0084 kopeck per pood in carload lots and 0.0184 kopeck per pood in less than carloads.

Chinese Eastern and Ussuri Railways: Lumber is divided into two categories—first, undressed lumber; second, dressed lumber, manufactured wood, etc. Harbin to Habarovsk, 1,246 versts (826.10 miles) maximum distance; transportation charge, first category, 0.21¾ kopeck (1.12 mills) per pood; second category, 0.1835 kopeck (0.94 mill) per pood. In carload lots, first and second categories, 0.5247 kopeck (2.7 mills) for shipments in less than carload lots. Terminal charge, 0.0084 kopeck (0.043 mill) per pood in carload lots and 0.0134 kopeck (0.095 mill) per pood in less than carload lots.

(*d*) The terminal charges include station expenses, loading, and unloading.

(*e*) The rate is a normal class rate.

(*f*) Additional charges are made for fast freight, and the rate is higher when less than one carload is shipped, but no difference is made in the rate for more than one carload.

(*g*) The above are published rates, but special rates are occasionally granted in order to transport lumber from different forests. These special rates are published weekly by the railway department at St. Petersburg as they are granted.

### *4. Fertilizer.*

(*a*, *b*, *c*) Chinese Eastern Railway: Pogranitchnaya to Manchuria, 1,388 versts (920.24 miles) maximum distance; transportation charge, 36 kopecks (18.54 cents) per pood; terminal charge, 0.0154 kopeck (0.079 mill) per pood in carload lots and 0.0194 kopeck (0.1 mill) per pood in less than carloads.

Ussuri Railway: Vladivostok, 716 versts (474.71 miles) maximum distance; transportation charge, 9 kopecks (4.63 cents) per pood; terminal charge, 0.0154 kopeck (0.079 mill) per pood in carload lots and 0.0194 kopeck (0.1 mill) per pood in less than carloads.

Chinese Eastern and Ussuri Railways: Harbin to Habarovsk, 1,246 versts (826.10 miles) maximum distance; transportation charge, 0.2091 kopeck (1.08 mills) per pood in carload lots and 0.3723 kopeck (1.92 mills) per pood in less than carloads. The terminal charge is 0.0154 kopeck (0.079 mill) per pood in carload lots and 0.0194 kopeck (0.1 mill) per pood in less than carloads.

(*d*) The terminal charges include station expenses, loading, and unloading.

(*e*) The rate is a normal class rate.

(*f*) Additional charges are made for fast freight, and the rate is higher when less than one carload is shipped, but no difference is made in the rate for more than one carload.

The tariff on various fertilizers is different, but for the purpose of the above example manure was taken.

### *5. Grain.*

Chinese Eastern Railway: Pogranitchnaya to Manchuria, 1,388 versts (920.24 miles) maximum distance; transportation charge, 41 kopecks (22.11 cents) per pood; terminal charge, 0.0162 kopeck (0.089 mill) per pood in carload lots and 0.0202 kopeck (0.1 mill) per pood in less than carloads.

Ussuri Railway: Vladivostok to Habarovsk, 716 versts (474.71 miles) maximum distance; transportation charge, 16 kopecks (8.24 cents) per pood; terminal charge, 0.0162 kopeck (0.089 mill) per pood in carload lots and 0.0202 kopeck (0.1 mill) per pood in less than carloads.

Chinese Eastern and Ussuri Railways: Harbin to Habarovsk, 1,246 versts (826.10 miles), maximum distance; transportation charge, 0.3118 kopeck (1.6 mills) per pood in carload lots and 0.577 kopeck (2.97 mills) per pood in less than carloads. The terminal charge is 0.0162 kopek (0.089 mill) per pood in carload lots and 0.0202 kopeck (0.1 mill) per pood in less than carloads.

(*d*) The terminal charges include station expenses, loading and unloading.

(*e*) The rate is a normal class rate.

(*f*) Additional charges are made for fast freight, and the rate is higher when less than one carload is shipped, but no difference is made in the rate for more than one carload.

(*g*) The above are published rates, but special rates are occasionally granted in order to transport grain from different points. These special rates are published in a weekly publication issued by the railway department at St. Petersburg.

## III. Special Export Rates.

The following table shows the local and transit freight rates and terminal charges per pood from Station Manchuria, the most westerly point on the Chinese Eastern Railway to Vladivostok, the terminus of the Ussuri Railway, a distance of 1,588 versts (1,052.84 miles):

| | Local rate. | | Transit rate. | |
|---|---|---|---|---|
| | Kopecks. | Equivalent in cents. | Kopecks. | Equivalent in cents. |
| Coal | 33 | 17 | 33 | 17 |
| Iron ore | 32 | 16.48 | [1] | |
| Stone | 28 | 14.42 | [1] | |
| Lumber | 21 | 10.81 | 18 | 9.27 |
| Fertilizer | 39 | 20.08 | [1] | |
| Grain | 47 | 24.20 | 44 | 22.66 |

[1] None granted.

The terminal charges are the same as in the answers to the previous questions.

## IV. Highest Grade of Classified Freight.

The rates corresponding to the express business in the United States are fast-freight rates. Example: Vladivostok to Habarovsk, 716 versts (474.71 miles): transportation charge, 0.6635 kopecks (3.42 mills) per pood; by fast freight, 1.0143 roubles (52.23 cents). Terminal charges depend upon the character of the goods and the method of packing, and include station expenses, loading and unloading.

For answers to Question V see replies to Questions I and II.

## VI. Basis of Rates.

The rates are based absolutely on distance. The tariff of the Ussuri Railway being the same tariff as used on all Government railways operating in Russian territory, and is published in such a form as to show the distance from 1 to 9,000 versts (0.663 to 5,967 miles) and divided into various classifications, the rate gradually decreasing as the distance increases. A similar tariff is published for the Eastern Railway, also a Government-owned railway, but operating in China and under a different tariff schedule.

## CHAPTER II.

## RIVERS AND CANALS IN RUSSIA.

The total length of rivers, lakes, and canals in European Russia, exclusive of Finland, serving as means of communication is 221,573 versts (147,715 miles). Rafting and navigation is carried on over a length of 168,259 versts (112,173 miles), as follows: 75 per cent of the total length of all inland waterways, or 126,649 versts (84,433 miles), are used exclusively for rafting lumber and towing vessels, and 41,610 versts (27,740 miles), or about 25 per cent are navigable. Steamship communication extends over a distance of 29,471 versts (19,647 miles), nearly 18 per cent of the total waterways.

This system of waterways comprises 3,158 rivers and their tributaries, 202 lakes, and 138 canals.

Out of the above-named number of rivers, there are 52 of a length of more than 500 versts (333 miles), and 12 of these of more than 1,000 versts (667 miles), viz:

| | Versts. | Equivalent in miles. | | Versts. | Equivalent in miles. |
|---|---|---|---|---|---|
| Volga | 3,463 | 2,309 | Petchora | 1,600 | 1,067 |
| Ural | 2,290 | 1,527 | Oka | 1,425 | 950 |
| Dnieper | 2,140 | 1,427 | Bielaya | 1,287 | 858 |
| Kama | 1,883 | 1,255 | Kur | 1,220 | 813 |
| Don | 1,860 | 1,240 | Viatka | 1,170 | 780 |
| Northern Dvina | 1,700 | 1,133 | Desna | 1,105 | 737 |

The Neva River, in connection with the Ladoga Lake, the Volkhov and Msta Rivers, and the latter's tributary, the Tsna River, constitutes a length of 950 versts (633 miles), and the Northern Donetz is 990 versts (660 miles) long.

Besides this, large rivers are flowing through European Russia and along its boundaries: the Danube River, 2,700 versts, or 1,800 miles long, flows along the Russian border over a distance of 147 versts (99 miles); the Dniester, of a length of 1,276 versts (851 miles) runs for 831 versts (554 miles) through Russian territory; and the Vistula, 1,025 versts (683 miles) long, flows through Russia for a distance of 618 versts (412 miles), through Austria, 190 versts (127 miles), and Prussia, 217 versts (145 miles).

Out of the 202 navigable lakes, 10 comprise an area of more than 500 square versts (333 square miles), as follows:

| | Square versts. | Equivalent in square miles. |
|---|---|---|
| In the watershed of the Baltic Sea: | | |
| Ladoga | 15,923 | 10,615 |
| Onega | 8,569 | 5,713 |
| Peipus | 3,205 | 2,137 |
| Bielo | 988 | 659 |
| Ilmen | 807 | 538 |
| In the watershed of the White Sea: | | |
| Sego | 1,094 | 729 |
| Toppa | 935 | 623 |
| Wygo | 756 | 504 |
| Imandra | 748 | 495 |
| In the watershed of the Caspian Sea: Gotcha | 1,224 | 816 |

## I. Public Supervision.

(*a*) Thirty-five of the 138 navigable canals in Russia, with a length of 831 versts (554 miles) are under the supervision of the ministry of ways and means of communication; 5 navigable canals, 11½ versts (7½ miles) long, are supervised by the St. Petersburg municipality; six towing canals, 36 versts (24 miles) long are maintained by various institutions and private persons; while 92 towing canals of a total length of 1,881 versts (1,254 miles) are operated by the land improving department of the ministry of agriculture.

One thousand and ninety-five versts (730 miles) of canalized rivers, or those equipped with locks, are under the supervision of the ministry of ways and means of communication.

Of all the artificial navigable waterways in European Russia (dug canals and canalized rivers), those maintained by the ministry of ways and means of communication comprise a length of 1,926 versts (1,284 miles).

All inland waterways, navigable streams, and canals are under the supervision of so-called navigation inspectors, who are appointed by the ministry of ways and means of communication.

(*b*) These officials do not exercise any power or duties in regard to the capitalization of navigation corporations. As regards freight rates, the ministry of ways and means of communication fixes the maximum rate and whatever is under this maximum is determined by the corporations themselves. This, however, applies only to such waterways and vessels as carry mail and are subject to a fixed time schedule.

Reports of operation are compiled by the inspectors of navigation and pertain to artificial waterways only. These reports are submitted to the ministry once per month; on all other waterways only reports on accidents are made.

In regard to the maintenance and improvements of channels, locks, and terminal facilities, reports are called for from time to time by the ministry of ways and means of communication.

2. Statistics of water-borne traffic are compiled and published by the bureau of statistics and mappery of the ministry of ways and means of communication.

## II. Waterway Improvements.

(*a*) There is no established policy as to the development of water power by works constructed for improving navigation. Recently, however, the third Duma called for a regular report upon the improvement of inland waterways, and the ministry of ways and means of communication is now preparing the report in question.

(*b*) River improvements and construction of canals have been almost exclusively carried on by the central Government. The most important improvements of recent date were: The sluicing of the upper Oka River, from Kolomna to Riazan, a distance of 140 versts (93 miles); the sluicing of the Northern Donetz River; and in the introducing of modern dredging machinery.

It might be of interest to note that according to a convention between Russia, Austria, and Germany, that part of the Vistula River which flows through Russia should have been dredged to the extent of 75 per cent, but only 25 per cent has been accomplished, notwithstanding the fact that the Government appropriated over $7,500,000 for this purpose.

(*c*) The Mariinsk Canal system, the largest and most important one in Russia, unites the Volga River at the city of Rybinsk with the St. Petersburg seaport, thus uniting the Caspian with the Black Sea. The total length of this canal is 1,062 versts (708 miles), comprising the following waterways:

(A) *Baltic branch.*—(1) The Neva River from its source, the Ladoga Sea, to the port of St. Petersburg, 69.5 versts (46.3 miles). (2) The Ladoga canals: (*a*) The Emperor Alexander II Canal, from the source of the Neva River to the Volkhova River, 104 versts (69 miles); (*b*) the Empress Maria Feodorovna Canal, from the Volkhova River to the Siasa River, 11 versts (7.5 miles); (*c*) the Emperor Alexander III Canal, from the Siasa River to the Svir River, 43 versts (29 miles). (3) The Svir River almost from its mouth, the Ladoga Lake to its source, the Onega Lake, 194 versts (129 miles). (4) The Onega Canal from the Svir River to the Vitegra River, 63 versts (42 miles). (5) The Vitegra River from the Onega Canal to the city of Vitegra, 9.5 versts (6.3 miles). (6) The sluiced part of the Vitegra River from St. Sergius Lock at the city of Vitegra to the St. Peter Lock, 43.7 versts (27 miles).

(B) *Watershed.*—(7) The Novo-Mariinsk Canal system between the St. Peter and St. Alexander Locks, 8 versts (5.3 miles).

(C) *Caspian branch.*—(8) The sluiced part of the Koshva River from the St. Alexander Lock to the St. Constantine Lock, 28.55 versts (19 miles). (9) The Koshva River from St. Constantine Lock to the Bielosersk Canal, 37 versts (25 miles). (10) The Bielosersk Canal from the Koshma River to the Sheksna River, 63.25 versts (44 miles). (11) The sluiced part of the Sheksna River from the Bielosersk Canal, 98.33 versts (66 miles). (12) The Sheksna River to its mouth into the Volga River at the city of Rybinsk, 289.17 versts (193 miles).

Thus the Mariinsk waterway comprises a length of 599.16 versts (399 miles) of navigable rivers, and 462.84 versts (309 miles) of sluiced rivers and canals.

The watershed of the Mariinsk Canal system is 396 feet above the sea level of the Baltic Sea and 138 feet above that of the Volga River at Rybinsk. The part between St. Petersburg and the first lock on the Vitegra River is gradually rising and reaches at the St. Sergius

Lock a height of 115 feet above the level of the Baltic Sea. A further elevation, up to 281 feet, is overcome by means of 14 dams and 29 locks. At the entrance to the Volga River there are 7 dams and an equal number of locks.

The Mariinsk Canal system carries vessels 224 feet long and 31.5 feet wide, with a carrying capacity of 810 tons.

Due to the climatic conditions, the Mariinsk waterway is only navigable from the beginning of May until the early part of October, and during this period 2,700 vessels can be locked in both directions, making a total of 5,400 vessels with a carrying capacity of 4,374,000 tons.

The Mariinsk waterway connects with the railway system of the Russian Empire at St. Petersburg and Rybinsk, and crosses the railway lines only once at Ust-Ougolsk on the Sheksna River, on the line of the St. Petersburg-Vologda-Viatka railway, 273 versts (182 miles) north of Rybinsk.

The following waterways join the Mariinsk Canal: (1) The Vishne-Volotsk system, by the way of the Volkhov River, uniting the Volga, through its tributary, the Tvertza River, with St. Petersburg. (2) The Tikhvinsk system, by the way of the Siasa River, uniting the Volga with the Neva through the Mologa River. This waterway carries vessels 84 feet long and 14 feet wide with a carrying capacity of 100 tons. (3) The Duke of Württemberg system, which by the way of the Sheksna River and through the Kubensk Lake, the Sukhona and Northern Dvina Rivers, unites the White Sea at the city of Arkhangelsk. The distance from St. Petersburg to Arkhangelsk over this waterway is about 2,068 versts (1,379 miles). This canal system carries vessels 154 feet long and 28 feet wide, with a carrying capacity of 330 tons.

## III. Floating Equipment.

(*a*) 1. The bulk of the freight is carried on barges towed by river steamers and tugboats; horses are also employed in the towing of barges. The steamers carrying freight and passengers on the Volga River are of a modern type, like those used on the Mississippi and other large rivers in the United States.

2. There are no self-propelled barges and canal boats; they are either towed by steamers, steam tugs, or by horses.

On some of the smaller rivers, where the barges are equipped with sails, they are towed by men when the wind slackens.

3–4. The total number of all vessels navigating on Russia's inland waterways is 26,154, and their original cost 193,929,000 rubles ($99,873,425), or an average of 8,000 rubles ($4,200) per vessel. The number of steamers is 3,295, and their original cost 133,296,000 rubles ($68,847,440). The total nominal motive power of these vessels is 165,004 horsepower.

| Types of vessels. | Number. | Average nominal horsepower. |
|---|---|---|
| Passenger | 318 | 75 |
| Passenger and freight | 459 | 42 |
| Freight | 105 | 79 |
| Tugs | 2,036 | 51 |

There are 2,805 iron and 490 wooden vessels plying on inland waterways. Data as to the use of iron, steel, and wood in vessel construction are not available.

The following table illustrates the size and draft of vessels:

| | Vessels. |
|---|---|
| Length: | |
| Up to 70 feet | 953 |
| From 70 to 140 feet | 1,238 |
| From 140 to 210 feet | 871 |
| Over 210 feet | 231 |
| Width: | |
| Up to 14 feet | 1,322 |
| From 14 to 21 feet | 1,114 |
| From 21 to 28 feet | 670 |
| Over 28 feet | 154 |
| Height (measured in the center of the vessel, exclusive of superstructions): | |
| Up to 7 feet | 1,406 |
| From 7 feet to 10 feet 6 inches | 1,368 |
| From 7 feet 10 inches to 14 feet | 280 |
| From 14 feet upward | 70 |
| Draft with cargo: | |
| Up to 2 feet 4 inches | 436 |
| From 2 feet 4 inches to 3 feet 6 inches | 759 |
| From 3 feet 6 inches to 4 feet 8 inches | 429 |
| Over 4 feet 8 inches | 684 |
| Tonnage: | |
| Up to 16 tons | 1,131 |
| From 16 to 80 tons | 1,225 |
| From 80 to 160 tons | 451 |
| Over 160 tons | 278 |
| Speed (per hour against current): | |
| Up to 2 miles | 337 |
| From 2 to 3⅜ miles | 956 |
| From 3⅜ to 6⅝ miles | 718 |
| Speed not reported | 431 |
| Nominal power: | |
| Up to 30 horsepower | 1,472 |
| From 30 to 60 horsepower | 1,004 |
| From 60 to 100 horsepower | 490 |
| Over 100 horsepower | 329 |
| Original cost of vessels: | |
| Up to $5,150 | 832 |
| From $5,150 to $25,750 | 1,611 |
| From $25,750 to $51,500 | 617 |
| Over $51,500 | 235 |

(5) The following examples are given as to the cost of the various types of boats:

Passenger and freight steamer, iron and steel construction: Length, 270 feet; width, 58 feet; height, 27 feet; draft without cargo, 40 inches; with cargo, 6 feet 5 inches; carrying capacity, 618 tons; 227 horsepower; 2 boilers; cost about $103,000.

Freight steamer, iron and steel construction: 158 feet long, 25 feet wide, 15 feet high; draft without cargo, 14 inches; with cargo, 38½ inches; carrying capacity, 165 tons; 30 horsepower; 1 boiler; cost about $15,450.

Barges, iron: Length, 140 to 280 feet; width, 28 to 42 feet; height, 3½ to 21 feet; draft without cargo, 7 to 28 inches; with cargo, 28 inches to 7 feet; carrying capacity, 160 to 1,065 tons; cost from $5,150 to $40,685.

Barges, wooden: Length, 70 to 434 feet; width, 14 to 56 feet; height, 3½ to 14 feet; draft without cargo, 7 to 28 inches; with cargo,

28 inches to 7 feet; carrying capacity, from 320 to 5,242 tons; cost from $2,575 to $10,300.

Naphtha barges, iron: Length, 210 to 504 feet; width, 35 to 72 feet; height, 7 to 14 feet; draft without cargo, 7 inches: with cargo, 7 feet and more; carrying capacity, up to 9,032 tons; cost from $10,300 to $66,950.

Naphtha barges, wooden: Length, 105 to 507 feet; width, 24 to 64 feet; height, 3½ to 14 feet; draft without cargo, 7 to 28 inches: with cargo, 3 feet 6 inches to 11 feet 1 inch; carrying capacity, from 160 to 7,257 tons; cost up to $15,450.

Barks: Length, 70 to 294 feet; width, 14 to 55 feet; height, 3½ to 15 feet; draft without cargo, 7 to 21 inches; with cargo, 28 to 130 inches; carrying capacity, 50 to 3,225 tons; cost from $258 to $1,957.

(6) The vessels are either side-wheelers or propeller steamers: stern-wheelers are used on shallow rivers. A special type is adapted for naphtha cargoes.

(7) There are in all 23,175 barges, with a carrying capacity of from 160 to 9,654 tons.

(8) The types of boats are principally adapted to low-water stages, only some of them being constructed with a view to utilization in high water.

## IV. Ownership of Vessels and Business Organization.

(*a*) Waterway improvements are carried on by the Central Government with the exception of the Don estuary committee, which does not own or operate vessels.

(*b*) Extensive fleets on inland waterways are owned by the following corporations:

| | Steamers. | Waterway. |
|---|---|---|
| Nijni-Dnieper-Black Sea Co | 55 | Dnieper River and Black Sea. |
| Samolet Co | 31 | Volga River. |
| Caucasus & Mercury Co | 16 | Do. |
| Russian Co | 20 | Black Sea. |
| Kachkov Co | 12 | Oka River. |
| F. & G. Kamensky Bros. Co | 10 | Kama River. |
| Verkhni-Irtish Co | 11 | Siberia rivers. |

(*c*) In addition to these corporations just mentioned, vessels operating on inland waterways are owned by the Riazan-Uralsk Railway (two steamers, tonnage not reported); the Moscow-Windau-Rybinsk Railway (one steamer of 36 tons); the Vladikavkas Railway, and some large producing and distributing concerns, but there are no up-to-date statistics available, those given also include the seagoing fleets. In this connection the following table giving the number of vessels and registered tonnage, might be of interest:

| Owners. | Location. | Number of vessels. | Register (tons). |
|---|---|---|---|
| Nobel Bros. Co., oil | Baku | 13 | 7,455 |
| Mazut Co., oil | do | 10 | 5,833 |
| A. Mantasheff & Co., oil | do | 1 | 1,867 |
| Russian Naphtha Co., oil | Astrakhan | 2 | 180 |
| Caspian-Black Sea Naphtha Co | Batum | 2 | 47 |
| Onega Lumber Co., lumber | Onega | 3 | 181 |
| Oranienbaum Saw Mill Co., lumber | St. Petersburg | 5 | 52 |
| Stella Polare Lumber Co., lumber | Arkhangelsk | 2 | 51 |
| Marinaks Lumber Co., lumber | do | 1 | 29 |
| Sout-Russian Floating Elevator Co | Odessa | 4 | 43 |
| Taganrog Metallurgical Co | Taganrog | 1 | 37 |

(*d*) There are 626 vessels owned and operated by various Zemstvos (district and provincial assemblies created in 1864 on an elective basis). Statistics as to the type and size of the vessels are not available.

(*e*) There are no important instances of combinations or monopolies controlling towing on canals and rivers.

## V. Terminal Facilities.

(*a*) The lack of loading and unloading facilities are the striking features of the river and canal terminals.

(*b*) Loading and unloading vessels on inland waterways is done by hand; the laborers are peasants and the wages low. Therefore, the use of mechanical appliances is confined to windlasses.

(*c*) There are many railroad tracks located on inland waterways, permitting direct transfer between railroad and water lines, such as the Southern Railway, the Moscow-Windau-Rybinsk Railway, the Ekaternin Railway, and the Uralsk Railway. About 50 large and 10 small ports have belt railroads, connecting all the railroads at the port.

(*d*) All the river and canal terminals are owned by the Government, but some of the harbors are owned by railroad corporations and producing and distributing concerns.

(*e*) Dockage fees are given under the heading "Canals and waterways in the Baltic Provinces and adjoining territory," and "Waterways and canals in eastern Siberia."

## VI. Tolls and Freight Rates.

(*a*) No tolls are charged on canals and rivers, except as mentioned below:

(1) On the Ladoga Canal, one-half per cent of the value of the cargo, for compensation of the construction costs of the canal.

(2) On the Dniester River, one per cent of the value of the cargo, for improvements of said river.

(3) On the Tesa River, 1.43 rubles ($0.74) per vessel.

(4) On the Moscow River system: Manufactured articles, one one-hundreth kopeck per pood (0.05 mill per 36.12 pounds); provisions, grain, flour, groats, flax, and hemp, one one-hundred-and-thirtieth kopeck per pood (0.04 mill per 36.12 pounds); straw, hay, beams, timber, boards, lumber, cement, lime, bricks, building materials, iron ore, and pig iron, one one-hundred-and-sixtieth kopeck (0.032 mill) per pood.

(*b*) The elements entering into the making of towing rates on canals and rivers is the amount of goods to be transported, and is fixed by agreement only.

Published tariffs or towing rates are not available.

(*c*, *d*) There are no regular schedules of freight rates; they vary with traffic exigencies and are made by private agreement. The various transportation companies have schedules of freight rates, but they are not adhered to. Large concerns enter into an agreement with the transportation companies and the rate is fixed for the season and based upon the quantity of freight shipped.

The inland waterway rates are affected by the distance of haul, the quantity and character of the commodity offered.

The following table shows the inland water rates for cereals and iron ore on the principal rivers and canals during the various seasons of the year:

CEREALS.

| Waterways and termini. | Versts. | Equivalent in miles. | Time of shipment. | Rate per pood (36.12 pounds).[1] | |
|---|---|---|---|---|---|
| | | | | Kopecks. | Equivalent in U. S. currency. |
| VOLGA RIVER. | | | | | |
| Floated: | | | | | |
| Astrakhan–Tzaritzin | 463 | 306.97 | April | 2.25 | $0.0116 |
| Tzaritzin–Dubovka | 48 | 31.82 | do | 1.50 | .0077 |
| | | | August | 1.10 | .0057 |
| | | | October | 1.25 | .0064 |
| Saratov–Volsk | 126 | 83.54 | do | 1.20 | .0062 |
| Saratov–Balakov | 155 | 102.76 | June | 1.25 | .0064 |
| | | | July | 1.00 | .0052 |
| | | | August | 1.57 | .0107 |
| | | | September | 1.50 | .0077 |
| Pokrovsk–Dukhovnitzk | 208 | 137.90 | May | 2.00 | .0103 |
| Baronsk–Samara | 341 | 226.08 | June | 1.75 | .0090 |
| Khvalinsk–Samara | 198 | 131.27 | May | 1.25 | .0064 |
| Syzran–Samara | 114 | 75.58 | July | 1.00 | .0052 |
| | | | October | 2.00 | .0103 |
| Towed: | | | | | |
| Astrakhan–Tzaritzin | 463 | 306.97 | April–August | 2.25 | .0116 |
| | | | September | 1.50 | .0077 |
| | | | October | 2.50 | .0129 |
| Astrakhan–Dubovka | 511 | 338.79 | September | 3.50 | .0180 |
| | | | October | 1.50 | .0077 |
| Astrakhan–Saratov | 855 | 566.86 | April | 2.10 | .0108 |
| | | | July | 2.50 | .0129 |
| | | | August | 3.00 | .0155 |
| | | | September | 3.11 | .0160 |
| | | | October | 3.38 | .0174 |
| Astan–Volsk | 981 | 650.40 | do | 3.69 | .0190 |
| Astrakhan–Syzran | 1,152 | 763.78 | April | 3.25 | .0167 |
| | | | October | 4.22 | .0217 |
| Astrakhan–Samara | 1,266 | 839.36 | do | 7.00 | .0361 |
| Astrakhan–Simbirsk | 1,486 | 985.22 | September | 4.29 | .0221 |
| | | | October | 4.66 | .0240 |
| Astrakhan–Undora | 1,566 | 1,038.26 | do | 4.74 | .0244 |
| Tzaritzin–Dubovka | 48 | 31.82 | August | .90 | .0046 |
| Saratov–Sarepta | 413 | 273.82 | July | 3.50 | .0180 |
| Saratov–Dubovka | 344 | 228.07 | October | 3.00 | .0155 |
| Saratov–Balakov | 155 | 105.76 | do | 2.00 | .0103 |
| Saratov–Dukhovnitzk | 212 | 140.56 | May | 2.00 | .0103 |
| Saratov–Samara | 414 | 274.48 | April | 3.00 | .0155 |
| Pokrovskaya–Tzaritzin | 396 | 263.55 | do | 2.75 | .0142 |
| Volsk–Samara | 285 | 188.95 | May | 1.50 | .0077 |
| Syzran–Tzaritzin | 689 | 456.81 | April | 4.50 | .0232 |
| Syzrah–Samara | 114 | 75.58 | do | 1.50 | .0077 |
| | | | May–June | 1.00 | .0052 |
| Samara–Tzaritzin | 803 | 532.39 | April | 4.00 | .0206 |
| | | | May | 4.50 | .0232 |
| Samara–Pokrovskaya | 407 | 269.84 | October | 3.00 | .0155 |
| Samara–Balakov | 256 | 169.73 | September | 3.50 | .0180 |
| Beli Yar–Samara | 160 | 106.08 | June | .50 | .0026 |
| Sengilei–Samara | 164 | 108.73 | May | 2.00 | .0103 |
| Chasovnia–Samara | 224 | 148.51 | June | 1.50 | .0077 |
| Kasan–Sarepta | 1,260 | 835.38 | April | 3.75 | .0193 |
| Kasan–Pokrovskaya | 843 | 558.92 | August | 4.00 | .0206 |
| Kasan–Samara | 436 | 289.07 | July | 4.00 | .0206 |
| Kasan–Novodevitchaya | 317 | 210.17 | April | 4.00 | .0206 |
| Nijni–Novgorod–Tzaritzin | 1,642 | 1,088.65 | do | 4.00 | .0206 |
| | | | June | 6.50 | .0335 |
| | | | September–October | 5.00 | .0258 |
| Nijni–Novgorod–Saratov | 1,250 | 828.75 | August | 5.00 | .0258 |
| Nijni–Novgorod–Samara | 839 | 556.26 | do | 5.00 | .0258 |
| | | | October | 6.00 | .0309 |
| Nijni–Novgorod–Simbirsk | 619 | 410.40 | do | 4.00 | .0206 |
| Nijni–Novgorod–Tchasovnia | 615 | 407.74 | do | 4.00 | .0206 |
| Gorodetz–Stavropol | 812 | 538.36 | September–October | 5.00 | .0258 |

[1] To obtain the equivalent per short ton multiply figures in last column by 55.37.

CEREALS—Continued.

| Waterways and termini. | Versts. | Equivalent in miles. | Time of shipment. | Rate per pood (36.12 pounds). Kopecks. | Rate per pood (36.12 pounds). Equivalent in U. S. currency. |
|---|---|---|---|---|---|
| VOLGA RIVER—continued. | | | | | |
| Towed—Continued. | | | | | |
| Gorodetz-Tchasovnia | 664 | 440.23 | October | 5.00 | $0.0258 |
| Putchej-Samara | 935 | 619.90 | September | 6.00 | .0309 |
| Jurievetz-Samara | 976 | 647.09 | do | 5.50 | .0283 |
| Jurievetz-Stavropol | 900 | 596.70 | October | 6.00 | .0309 |
| Jurievetz-Tchasovnia | 752 | 498.58 | do | 5.28 | .0272 |
| Jurievetz-Ust-Maini | 699 | 463.44 | do | 5.75 | .0296 |
| Kineshma-Syzran | 1,152 | 763.78 | September | 4.50 | .0232 |
| Kineshma-Samara | 1,038 | 688.19 | April | 5.79 | .0298 |
| | | | September | 6.00 | .0309 |
| Kineshma-Stavropol | 962 | 637.81 | October | 6.00 | .0309 |
| Kineshma-Khretchevka | 892 | 591.40 | do | 6.00 | .0309 |
| Kineshma-Simbirsk | 818 | 542.33 | April | 6.00 | .0309 |
| | | | October | 4.50 | .0232 |
| Kineshma-Tchasovnia | 814 | 542.33 | do | 6.00 | .0309 |
| Kineshma-Ust-Maini | 761 | 504.54 | September | 5.32 | .0274 |
| | | | October | 5.00 | .0258 |
| Pless-Stavropol | 1,010 | 669.63 | September | 5.00 | .0258 |
| Kostroma-Sarepta | 1,970 | 1,306.11 | April | 4.25 | .0219 |
| Kostroma-Tzaritzin | 1,949 | 1,282.19 | do | 4.75 | .0245 |
| Kostroma-Pokrovskaya | 1,553 | 1,029.64 | June | 5.00 | .0258 |
| | | | August | 6.00 | .0309 |
| | | | September | 6.00 | .0309 |
| Kostroma-Balakov | 1,402 | 929.53 | April | 5.50 | .0283 |
| | | | September | 6.30 | .0324 |
| Kostroma-Dukhovnitzk | 1,345 | 891.73 | do | 6.00 | .0309 |
| Kostroma-Samara | 1,146 | 759.80 | May | 6.00 | .0309 |
| | | | June-July | 5.00 | .0258 |
| | | | September | 6.00 | .0309 |
| Kostroma-Beli Yar | 986 | 653.72 | October | 5.00 | .0258 |
| Kostroma-Ust-Maini | 869 | 576.15 | September | 6.08 | .0313 |
| Yaroslav-Balakov | 1,478 | 979.91 | do | 6.00 | .0309 |
| Yaroslav-Samara | 1,222 | 810.19 | May | 7.00 | .0360 |
| | | | August | 5.00 | .0258 |
| | | | September | 6.09 | .0314 |
| Yaroslav-Tchasovnia | 998 | 661.67 | October | 6.50 | .0335 |
| Rybinsk-Sarepta | 2,133 | 1,414.18 | April | 4.75 | .0245 |
| Rybinsk-Saratov | 1,720 | 1,140.36 | May-June | 5.00 | .0258 |
| | | | August | 6.00 | .0309 |
| Rybinsk-Balakov | 1,565 | 1,037.59 | April-May | 6.50 | .0335 |
| | | | June | 6.22 | .0420 |
| | | | August-September | 6.00 | .0309 |
| Rybinsk-Dukhovnitzk | 1,508 | 999.80 | September | 6.00 | .0309 |
| Rybinsk-Batrakov | 1,413 | 936.82 | May | 5.00 | .0258 |
| Rybinsk-Syzran | 1,423 | 943.45 | April | 4.85 | .0250 |
| | | | May | 5.00 | .0258 |
| | | | June | 4.75 | .0245 |
| | | | July-September | 5.00 | .0258 |
| Rybinsk-Ekaterinovka | 1,354 | 897.70 | April | 6.00 | .0309 |
| Rybinsk-Samara | 1,309 | 867.87 | April-May | 6.00 | .0309 |
| | | | June | 5.74 | .0296 |
| | | | August | 6.00 | .0309 |
| | | | September | 5.63 | .0289 |
| Rybinsk-Stavropol | 1,233 | 817.48 | do | 5.95 | .0306 |
| | | | October | 5.50 | .0283 |
| Rybinsk-Khriatchevki | 1,163 | 771.07 | do | 4.50 | .0232 |
| Rybinsk-Beli Yar | 1,149 | 761.79 | do | 5.50 | .0283 |
| Rybinsk-Sengilei | 1,145 | 759.13 | August | 5.00 | .0258 |
| | | | September | 7.00 | .0361 |
| | | | October | 5.76 | .0297 |
| Rybinsk-Simbirsk | 1,089 | 722.00 | August | 5.00 | .0258 |
| | | | September | 4.72 | .0243 |
| | | | October | 5.83 | .0300 |
| Rybinsk-Tchasovnia | 1,085 | 719.35 | August | 4.75 | .0245 |
| Rybinsk-Undor | 1,059 | 702.12 | September | 4.50 | .0232 |
| | | | October | 5.23 | .0269 |
| Rybinsk-Ust-Maini | 1,032 | 684.22 | September | 6.33 | .0326 |
| Kaliasin-Rybinsk | 167 | 110.72 | July | 3.00 | .0155 |
| | | | August | 2.50 | .0129 |
| | | | September | 3.00 | .0155 |
| Kimra-Rybinsk | 236 | 156.47 | May | 3.00 | .0155 |
| Tver-Rybinsk | 365 | 241.99 | July | 3.00 | .0155 |
| | | | August | 3.75 | .0326 |
| | | | September | 4.54 | .0234 |

CEREALS—Continued.

| Waterways and termini. | Versts. | Equivalent in miles. | Time of shipment. | Rate per pood (36.12 pounds). Kopecks. | Rate per pood (36.12 pounds). Equivalent in U. S. currency. |
|---|---|---|---|---|---|
| VOLGA RIVER—continued. | | | | | |
| Towed—Continued. | | | | | |
| Torjok–Rybinsk | 447 | 296.36 | May | 5.50 | $0.0283 |
| | | | June | 6.00 | .0309 |
| | | | July | 5.53 | .0285 |
| | | | August | 5.06 | .0260 |
| | | | September | 5.06 | .0260 |
| Staritza–Rybinsk | 450 | 298.35 | May | 6.00 | .0309 |
| | | | September | 6.50 | .0335 |
| Zubzov–Rybinsk | 509 | 337.47 | August | 6.25 | .0322 |
| Rjev–Rybinsk | 533 | 353.38 | May | 7.00 | .0361 |
| | | | June | 6.84 | .0352 |
| | | | August | 6.00 | .0309 |
| | | | September | 7.91 | .0407 |
| Selijarovo–Rybinsk | 666 | 441.56 | May | 10.93 | .0563 |
| | | | August | 10.50 | .0541 |
| VOLGA–KAMA RIVERS. | | | | | |
| Towed: | | | | | |
| Astrakhan–Tchistopol | 1,742 | 1,154.95 | April | 5.00 | .0258 |
| Simbirsk–Levshin | 1,005 | 666.31 | do | 6.02 | .0310 |
| Kasan–Levshin | 941 | 623.88 | do | 6.00 | .0309 |
| Nijni–Novgorod–Levshin | 1,344 | 891.07 | June–September | 7.00 | .0361 |
| Gorodetz–Tchistopol | 642 | 425.65 | October | 4.50 | .0232 |
| Kostroma–Tchistopol | 902 | 598.03 | September | 6.50 | .0335 |
| Yaroslav–Tchistopol | 978 | 648.41 | do | 6.50 | .0335 |
| Rybinsk–Murzikhi | 1,011 | 670.29 | May | 3.56 | .0183 |
| Rybinsk–Rybnaya Sloboda | 1,028 | 681.56 | September | 4.78 | .0246 |
| Rybinsk–Tchistopol | 1,065 | 706.09 | April | 3.78 | .0195 |
| | | | May | 3.51 | .0181 |
| | | | June | 4.29 | .0221 |
| | | | August | 4.85 | .0250 |
| | | | September | 4.77 | .0246 |
| | | | October | 5.00 | .0258 |
| Rybinsk–Taborsk | 1,696 | 1,124.45 | May | 7.00 | .0361 |
| Rybinsk–Levshin | 1,814 | 1,202.68 | April | 8.00 | .0412 |
| | | | June | 9.00 | .0464 |
| Tchistopol–Ekaterinovka | 521 | 345.43 | May | 7.00 | .0361 |
| Tchistopol–Samara | 476 | 315.59 | April | 8.00 | .0412 |
| Sarapul–Syzran | 931 | 617.25 | September | 7.50 | .0386 |
| Sarapul–Samara | 817 | 541.67 | do | 8.00 | .0412 |
| Ust Retchka–Samara | 894 | 592.72 | do | 7.00 | .0361 |
| Ossa–Samara | 1,025 | 679.57 | do | 7.35 | .0379 |
| Perm–Syzran | 1,323 | 877.15 | do | 9.00 | .0464 |
| Perm–Samara | 1,209 | 801.57 | April–May | 8.00 | .0412 |
| | | | September | 6.70 | .0345 |
| Medwedka–Samara | 822 | 544.99 | do | 7.00 | .0361 |
| Viatka–Samara | 1,185 | 785.65 | April | 8.00 | .0412 |
| | | | September | 6.70 | .0345 |
| Slobodskaya–Samara | 1,261 | 836.04 | April | 8.00 | .0412 |
| Kukarka–Samara | 936 | 620.57 | do | 8.00 | .0412 |
| VOLGA–VETLUGA RIVERS. | | | | | |
| Towed: | | | | | |
| Varnavin–Samara | 863 | 572.17 | April | 7.00 | .0361 |
| Baki–Samara | 825 | 546.97 | do | 7.00 | .0361 |
| VOLGA–OKA RIVERS. | | | | | |
| Towed: Rybinsk–Korshunovka | 1,016 | 673.61 | April | 9.00 | .0464 |
| OKA RIVER. | | | | | |
| Floating downstream (horse draft upstream): | | | | | |
| Nijni–Novgorod–Terngenev | 392 | 259.90 | September | 7.00 | .0361 |
| Murom–Ternikov | 323 | 214.05 | do | 5.00 | .0258 |
| Murom–Aksel | 345 | 228.73 | April | 8.00 | .0412 |
| Murom–Terngenev | 190 | 125.97 | September | 5.00 | .0258 |
| Murom–Korshanovka | 344 | 228.07 | April | 6.02 | .0310 |
| Liaki–Tergenev | 147 | 97.46 | June | 5.00 | .0258 |
| | | | September | 4.00 | .0206 |
| | | | October | 5.00 | .0258 |
| Dmitri Gor–Tergenev | 126 | 83.54 | August–September | 4.48 | .0231 |

CEREALS—Continued.

| Waterways and termini. | Versts. | Equivalent in miles. | Time of shipment. | Rate per pood (36.12 pounds). Kopecks. | Rate per pood (36.12 pounds). Equivalent in U. S. currency. |
|---|---|---|---|---|---|
| OKA RIVER—continued. | | | | | |
| Floating downstream (horse draft upstream)—Continued. | | | | | |
| Santchur–Tergenev | 126 | 83.54 | August | 4.51 | $0.0232 |
| Elatma–Oushakov | 103 | 68.29 | May | 5.00 | .0258 |
| Vatashka–Tergenev | 66 | 43.76 | June | 8.00 | .0412 |
| | | | August | 3.00 | .0155 |
| | | | September | 5.00 | .0258 |
| Visokaya Poliana–Tergenev | 63 | 41.77 | April | 3.00 | .0155 |
| Aseyevo–Tergenev | 45 | 29.83 | do | 4.00 | .0206 |
| | | | June | 3.30 | .0170 |
| Kadom–Tergenev | 64 | 42.43 | April | 4.00 | .0206 |
| | | | May | 4.87 | .0251 |
| | | | June | 5.70 | .0294 |
| | | | July–September | 4.00 | .0206 |
| Kadom–Oushakov | 68 | 45.08 | May | 5.03 | .0259 |
| | | | June | 6.00 | .0309 |
| | | | July | 4.57 | .0235 |
| Tengushevo–Tegmenev | 105 | 69.61 | April | 6.00 | .0309 |
| | | | May | 6.20 | .0319 |
| | | | June | 6.59 | .0339 |
| | | | July | 6.00 | .0309 |
| Tengushevo–Oushakov | 109 | 72.27 | May | 6.24 | .0321 |
| | | | June | 6.25 | .0322 |
| | | | July | 6.00 | .0309 |
| Tcherneyevo–Morshansk | 63 | 41.77 | April | 5.24 | .0270 |
| Murom–Seim River, towed | 138 | 91.49 | July | 4.00 | .0206 |
| MARIINSK CANAL. | | | | | |
| Towed and horse draft: | | | | | |
| Viterga–Rybinsk | 569 | 377.25 | May | 4.00 | .0206 |
| | | | September | 5.57 | .0287 |
| Vosnesenye–Rybinsk | 643 | 426.31 | May | 4.82 | .0248 |
| | | | June | 5.08 | .0262 |
| | | | July | 5.04 | .0260 |
| | | | August | 5.00 | .0258 |
| | | | September | 6.25 | .0322 |
| Sermaksa–Rybinsk | 823 | 545.65 | August | 6.61 | .0340 |
| St. Petersburg–Rybinsk | 1,054 | 698.80 | May | 5.76 | .0297 |
| | | | June | 5.73 | .0295 |
| | | | July | 5.93 | .0305 |
| | | | August | 6.02 | .0310 |
| | | | September | 8.09 | .0417 |
| TIKHVINSK CANAL. | | | | | |
| Towed by tugs and horse draft: | | | | | |
| Oustujna–Rybinsk | 256 | 169.73 | May | 3.32 | .0171 |
| | | | June | 3.12 | .0161 |
| | | | July | 3.16 | .0163 |
| | | | August | 3.36 | .0173 |
| | | | September | 4.52 | .0233 |
| Sonimo–Rybinsk | 411 | 272.49 | June | 6.79 | .0350 |
| | | | September | 10.40 | .0536 |
| Tikhvin–Rybinsk | 561 | 371.94 | May | 8.12 | .0418 |
| | | | June | 7.90 | .0407 |
| | | | July | 8.00 | .0412 |
| | | | August | 7.96 | .0410 |
| | | | September | 9.75 | .0502 |
| DVINA RIVER. | | | | | |
| Towed by tugs: | | | | | |
| Arkhangelsk–Kotlas | 599 | 397.14 | April–May | 4.00 | .0206 |
| | | | June | 3.59 | .0185 |
| | | | July | 3.69 | .0190 |
| | | | August | 3.87 | .0199 |
| | | | September | 4.00 | .0206 |
| Arkhangelsk–Veliki Ustjug | 666 | 441.56 | April–May | 4.00 | .0206 |
| Arkhangelsk–Totma | 922 | 611.29 | May | 5.00 | .0258 |
| Arkhangelsk–Shuisk | 1,061 | 703.44 | April–May | 7.00 | .0361 |
| Arkhangelsk–Vologda | 1,159 | 768.42 | do | 7.00 | .0361 |
| Arkhangelsk–Sholga | 743 | 492.61 | April | 5.50 | .0283 |
| Arkhangelsk–Nikolsk | 980 | 643.74 | May | 6.00 | .0309 |
| Kholmogory–Kotlas | 561 | 371.94 | do | 4.00 | .0206 |
| Pinega–Vologda | 1,179 | 781.68 | April | 7.00 | .0361 |
| Shenkursk–Vologda | 1,035 | 686.20 | May | 7.00 | .0361 |

CEREALS—Continued.

| Waterways and termini. | Versts. | Equivalent in miles. | Time of shipment. | Rate per pood (36.12 pounds). | |
|---|---|---|---|---|---|
| | | | | Kopecks. | Equivalent in U. S. currency. |
| DUENA RIVER. | | | | | |
| Floated: | | | | | |
| Riga–Druja | 317 | 210.17 | April | 5.00 | $0.0258 |
| Riga–Drissa | 351 | 232.71 | May–July | 6.00 | .0309 |
| Riga–Disna | 384 | 254.59 | April–July | 6.00 | .0309 |
| Riga–Beshenkovitchi | 505 | 334.81 | April | 8.82 | .0454 |
| | | | July | 8.00 | .0412 |
| Riga–Vitebsk | 569 | 377.25 | April | 13.00 | .0670 |
| Riga–Velish | 663 | 439.57 | do | 18.00 | .0927 |
| Dvinsk–Disna | 151 | 100.11 | October | 5.00 | .0258 |
| | | | November | 6.00 | .0309 |
| DNIESTER RIVER. | | | | | |
| Floated: | | | | | |
| Varnitza–Grigoriopol | 64 | 42.43 | April | 1.75 | .0090 |
| | | | May | 1.50 | .0077 |
| | | | June–September | 1.25 | .0064 |
| | | | October–November | 1.75 | .0090 |
| Varnitza–Dubossary | 80 | 53.04 | June | 1.50 | .0077 |
| | | | July | 1.25 | .0064 |
| Varnitza–Kriulan | 114 | 75.58 | May | 1.75 | .0090 |
| Varnitza–Dubossary | 118 | 78.23 | April–May | 2.50 | .0129 |
| | | | June | 2.00 | .0103 |
| | | | July | 1.75 | .0090 |
| | | | August–September | 2.00 | .0103 |
| | | | October | 2.25 | .0116 |
| | | | November | 2.50 | .0129 |
| Varnitza–Malovata | 133 | 88.18 | May–June | 2.00 | .0103 |
| | | | July | 1.75 | .0090 |
| | | | August–September | 2.00 | .0103 |
| | | | October | 2.50 | .0129 |
| | | | November | 2.62 | .0135 |
| Varnitza–Yagorlik | 144 | 95.47 | May | 2.50 | .0129 |
| | | | June–September | 2.25 | .0116 |
| | | | October | 2.75 | .0142 |
| Varnitza–Garmatzky | 153 | 101.44 | June | 2.00 | .0103 |
| | | | October | 2.75 | .0142 |
| Varnitza–Botushan | 167 | 110.72 | July | 2.00 | .0103 |
| | | | October | 3.00 | .0155 |
| Varnitza–Lalova | 173 | 114.68 | April | 3.00 | .0155 |
| | | | May | 3.75 | .0193 |
| | | | July | 2.25 | .0116 |
| | | | August–September | 2.50 | .0129 |
| | | | October–November | 3.00 | .0155 |
| Varnitza–Vada Rashkova | 223 | 147.83 | May | 4.00 | .0206 |
| | | | June | 2.25 | .0116 |
| | | | July | 2.16 | .0111 |
| Varnitza–Vadoima | 231 | 153.13 | April | 3.50 | .0180 |
| | | | May | 3.67 | .0189 |
| | | | July | 2.25 | .0116 |
| | | | August | 2.25 | .0116 |
| Varnitza–Senatovka | 239 | 158.43 | June | 2.50 | .0129 |
| Varnitza–Kamenka | 242 | 160.42 | April–May | 4.00 | .0206 |
| | | | June | 2.50 | .0129 |
| | | | July–August | 2.25 | .0116 |
| | | | September | 2.18 | .0112 |
| | | | October | 2.50 | .0129 |
| Varnitza–Napadov | 249 | 165.06 | June | 2.50 | .0129 |
| Varnitza–Vertujan | 255 | 169.04 | June–July | 2.50 | .0129 |
| Varnitza–Zalutchan | 260 | 172.35 | April | 4.00 | .0206 |
| | | | May | 4.50 | .0232 |
| | | | June | 2.75 | .0142 |
| | | | July | 2.50 | .0129 |
| Varnitza–Kuznim | 271 | 179.65 | June | 4.50 | .0232 |
| | | | August | 2.75 | .0142 |
| | | | September–October | 2.50 | .0129 |
| Varnitza–Grushka | 277 | 183.62 | June | 2.75 | .0142 |
| | | | August–September | 2.50 | .0129 |
| | | | October | 3.00 | .0155 |
| Varnitza–Nemerovka | 278 | 184.29 | May | 5.00 | .0258 |
| | | | June | 2.75 | .0142 |
| Varnitza–Voronovka | 286 | 189.62 | May | 4.80 | .0247 |
| | | | June | 2.74 | .0141 |
| | | | August–September | 2.50 | .0129 |
| | | | October | 3.00 | .0155 |

CEREALS—Continued.

| Waterways and termini. | Versts. | Equivalent in miles. | Time of shipment. | Rate per pood (36.12 pounds). | |
|---|---|---|---|---|---|
| | | | | Kopecks. | Equivalent in U. S. currency. |
| DNIESTER RIVER—continued. | | | | | |
| Floated—Continued. | | | | | |
| Varnitza-Vasilkov | 297 | 196.91 | May | 5.00 | $0.0258 |
| Varnitza-Velikaya | 298 | 197.57 | April-May | 4.50 | .0232 |
| | | | June | 3.00 | .0155 |
| | | | July-September | 2.50 | .0129 |
| | | | October | 3.00 | .0155 |
| Varnitza-Trefoutz | 306 | 202.88 | November | 3.00 | .0155 |
| Varnitza-Tolnikova | 314 | 208.18 | July | 2.50 | .0129 |
| Varnitza-Soroki | 314 | 208.18 | April | 4.50 | .0232 |
| | | | May | 4.99 | .0257 |
| | | | June | 3.00 | .0155 |
| | | | July-August | 2.50 | .0129 |
| | | | September | 2.92 | .0150 |
| | | | October-November | 3.00 | .0155 |
| Varnitza-Porogi | 330 | 218.79 | April | 4.50 | .0232 |
| | | | July | 2.75 | .0142 |
| | | | September | 3.00 | .0155 |
| Varnitza-Yampol | 332 | 220.12 | June | 3.50 | .0180 |
| | | | July | 2.50 | .0129 |
| Varnitza-Mikhailovka | 359 | 238.02 | May | 3.50 | .0180 |
| DNIESTER RIVER AND BLACK SEA. | | | | | |
| Floating along the Dniester River and towed in the Black Sea: | | | | | |
| Odessa-Grigoriopol | 349 | 231.39 | April | 5.25 | .0322 |
| | | | May | 5.75 | .0296 |
| | | | July | 5.50 | .0283 |
| Odessa-Kriuliani | 399 | 264.54 | June | 5.75 | .0296 |
| Odessa-Dubossary | 403 | 267.19 | April | 6.75 | .0348 |
| | | | May | 6.50 | .0335 |
| | | | June | 6.00 | .0309 |
| Odessa-Malovate | 418 | 277.13 | May | 7.00 | .0361 |
| | | | July | 6.00 | .0309 |
| | | | August | 6.25 | .0322 |
| Odessa-Yagorlik | 429 | 284.43 | June | 6.25 | .0322 |
| Odessa-Oksenti | 431 | 285.75 | August | 6.50 | .0335 |
| Odessa-Lalova | 458 | 303.65 | May | 7.50 | .0386 |
| | | | June-July | 7.00 | .0361 |
| Odessa-Velikaya Kosnitza | 583 | 386.58 | May | 5.50 | .0283 |
| BUG RIVER. | | | | | |
| By sailing crafts: | | | | | |
| Nikolaiev-Vosnesensk | 111 | 73.59 | May | 1.50 | .0077 |
| | | | July | 2.50 | .0129 |
| | | | August | 2.30 | .0118 |
| | | | September | 1.53 | .0079 |
| Towed by tugs: | | | | | |
| Nikolaiev-Vosnesensk | 111 | 753.59 | March | 2.00 | .0103 |
| | | | April | .94 | .0048 |
| | | | May-June | .75 | .0039 |
| | | | July | 1.03 | .0053 |
| | | | August | 1.43 | .0074 |
| | | | September-November. | 2.50 | .0129 |
| DNIEPER RIVER-BLACK SEA. | | | | | |
| By sailing crafts: | | | | | |
| Odessa-Tiaginka | 187 | 123.98 | November | 2.00 | .0103 |
| Odessa-Berislav | 219 | 145.20 | May | 1.56 | .0080 |
| | | | July | 1.50 | .0082 |
| | | | August | 3.00 | .0155 |
| | | | September | 2.50 | .0129 |
| | | | October-November | 3.00 | .0155 |
| Odessa-Kakhovka | 223 | 147.85 | May | 1.80 | .0093 |
| | | | July | 2.00 | .0103 |
| | | | September | 2.79 | .0144 |
| | | | November | 3.24 | .0167 |
| Odessa-Lepetikha | 281 | 186.30 | August | 5.00 | .0258 |
| Odessa-Nikopol | 354 | 234.70 | May | 2.50 | .0129 |
| | | | June | 2.10 | .0108 |
| Nikolaiev-Kamenka | 212 | 140.56 | November | 3.00 | .0155 |

CEREALS—Continued.

| Waterways and termini. | Versts. | Equivalent in miles. | Time of shipment. | Rate per pood (36.12 pounds). Kopecks. | Rate per pood (36.12 pounds). Equivalent in U. S. currency. |
|---|---|---|---|---|---|
| DNIEPER RIVER-BLACK SEA—contd. | | | | | |
| Towed by tugs: | | | | | |
| Odessa-Tiaginka | 187 | 123.98 | November | 4.00 | $0.0206 |
| Odessa-Britany | 203 | 134.59 | August | 2.00 | .0103 |
| | | | October | 2.30 | .0118 |
| Odessa-Berislav | 219 | 145.20 | May-September | 2.50 | .0129 |
| | | | October | 2.00 | .0103 |
| | | | November | 3.00 | .0155 |
| Odessa-Kakhovka | 223 | 147.85 | April | 3.10 | .0016 |
| | | | May | 1.00 | .0052 |
| | | | June | .50 | .0026 |
| | | | September | 2.12 | .0109 |
| | | | October | 2.10 | .0108 |
| | | | November | 2.51 | .0130 |
| Odessa-Lepetikha | 281 | 186.30 | May | 1.50 | .0077 |
| | | | September-October | 4.00 | .0206 |
| Odessa-Vorontzovka | 313 | 207.52 | September | 4.50 | .0232 |
| | | | October | 3.50 | .0180 |
| | | | November | 4.00 | .0206 |
| Odessa-Nikopool | 354 | 234.70 | May | 2.50 | .0129 |
| | | | June | 2.00 | .0103 |
| | | | September | 3.50 | .0180 |
| | | | November | 4.00 | .0206 |
| Odessa-Alexandrovsk | 436 | 289.07 | June | 2.50 | .0129 |
| | | | September | 4.00 | .0206 |
| | | | October | 5.73 | .0295 |
| Odessa-Tzarskaya | 443 | 293.71 | ....do | 6.00 | .0309 |
| Odessa-Sengirovka | 256 | 169.73 | September | 3.00 | .0155 |
| Nikolaiev-Kakhovka | 186 | 123.32 | April | 2.00 | .0103 |
| | | | May | 1.25 | .0064 |
| | | | October | 2.00 | .0103 |
| Nikolaiev-Kamenka | 212 | 140.56 | April | 2.00 | .0103 |
| | | | November | 5.00 | .0258 |
| Nikolaiev-Lepetikha | 244 | 161.77 | June | 1.50 | .0077 |
| Nikolaiev-Nikopol | 317 | 210.17 | April | 3.00 | .0155 |
| | | | September-November. | 4.00 | .0206 |
| Nikolaiev-Alexandrovsk | 399 | 264.54 | April | 3.00 | .0155 |
| | | | August | 4.50 | .0232 |
| | | | September | 6.00 | .0309 |
| DNIEPER RIVER. | | | | | |
| By sailing crafts: | | | | | |
| Kherson-Tiaginka | 36 | 23.87 | May | 1.37 | .0067 |
| | | | July | 2.06 | .0106 |
| | | | August | 1.84 | .0095 |
| | | | September | 2.02 | .0104 |
| | | | October | 1.95 | .0100 |
| | | | November | 2.00 | .0103 |
| Kherson-Britany | 52 | 34.48 | May | 2.50 | .0129 |
| | | | June | 1.31 | .0067 |
| | | | July | 1.60 | .0082 |
| | | | August | 1.68 | .0080 |
| | | | October | 2.00 | .0103 |
| Kherson-Berislav | 68 | 45.08 | March | 1.50 | .0077 |
| | | | April | 1.40 | .0072 |
| | | | May | 1.41 | .0073 |
| | | | June | 1.30 | .0067 |
| | | | July | 1.84 | .0095 |
| | | | August | 1.85 | .0095 |
| | | | September | 2.05 | .0105 |
| | | | October | 1.99 | .0102 |
| | | | November | 2.24 | .0115 |
| Kherson-Katcharovka | 112 | 74.26 | April | 1.80 | .0093 |
| | | | June | 1.57 | .0081 |
| | | | August | 2.41 | .0124 |
| Kherson-Lepetikha | 130 | 86.19 | July | 2.57 | .0132 |
| | | | August | 2.50 | .0129 |
| Kherson-Vorontzovka | 162 | 107.41 | May | 2.50 | .0129 |
| | | | July | 1.85 | .0095 |
| | | | August | 3.00 | .0155 |
| Kherson-Nikopol | 203 | 134.59 | April | 2.00 | .0103 |
| | | | May | 1.70 | .0088 |

CEREALS—Continued.

| Waterways and termini. | Versts. | Equivalent in miles. | Time of shipment. | Rate per pood (36.12 pounds). Kopecks. | Equivalent in U. S. currency. |
|---|---|---|---|---|---|
| DNIEPER RIVER—continued. | | | | | |
| By sailing crafts—Continued. | | | | | |
| Kherson–Tarasovka | 241 | 159.78 | July | 1.50 | $0.0077 |
| | | | August | 2.81 | .0145 |
| | | | September | 2.44 | .0126 |
| | | | October | 3.00 | .0155 |
| Kherson–Alexandrovsk | 285 | 188.95 | May | 1.90 | .0098 |
| | | | September | 3.50 | .0180 |
| Kherson–Galaganovk | 66 | 43.76 | May | 1.27 | .0065 |
| | | | July–September | 3.00 | .0155 |
| | | | October | 2.93 | .0151 |
| Kherson–Senigirevka | 105 | 69.61 | April | 1.86 | .0096 |
| | | | May | 1.78 | .0092 |
| | | | June | 2.00 | .0103 |
| | | | July | 2.38 | .0123 |
| | | | August | 2.82 | .0145 |
| | | | September | 3.18 | .0164 |
| | | | October | 3.26 | .0168 |
| | | | November | 3.00 | .0155 |
| Kherson–Evgenievka | 118 | 78.23 | August | 2.88 | .0148 |
| | | | September | 3.85 | .0198 |
| | | | October | 4.26 | .0219 |
| Towed by tugs: | | | | | |
| Kherson–Tiaginka | 36 | 23.87 | April | 1.04 | .0054 |
| | | | May | 1.50 | .0077 |
| | | | September | 1.74 | .0090 |
| Kherson–Britany | 52 | 34.48 | April | 1.50 | .0077 |
| | | | September | 1.79 | .0092 |
| Kherson–Berislav | 68 | 45.08 | May | 1.12 | .0058 |
| | | | June | 1.33 | .0068 |
| | | | July | 2.02 | .0104 |
| | | | August | 2.09 | .0108 |
| | | | September | 1.97 | .0101 |
| | | | October | 1.69 | .0087 |
| | | | November | 1.61 | .0083 |
| Kherson–Khakhovka | 72 | 47.74 | April | 1.37 | .0071 |
| | | | May | 1.30 | .0067 |
| | | | June | 1.42 | .0073 |
| | | | July | 1.59 | .0082 |
| | | | August | 1.67 | .0086 |
| | | | September | 2.12 | .0109 |
| | | | October | 1.83 | .0094 |
| | | | November | 2.26 | .0116 |
| Kherson–Kamenka | 98 | 64.97 | April | 2.50 | .0129 |
| | | | July | 2.95 | .0152 |
| | | | August | 3.11 | .0160 |
| | | | September | 4.00 | .0206 |
| | | | October | 4.05 | .0208 |
| | | | November | 3.00 | .0155 |
| Kherson–Kotcharovka | 112 | 74.26 | April | 1.67 | .0086 |
| | | | May | 1.88 | .0097 |
| | | | June | 1.54 | .0079 |
| | | | July | 2.14 | .0110 |
| | | | August | 2.19 | .0113 |
| | | | September | 2.49 | .0128 |
| | | | October | 2.79 | .0145 |
| | | | November | 2.00 | .0103 |
| Kherson–Lepetikha | 130 | 86.19 | April–July | 1.80 | .0093 |
| | | | August | 2.26 | .0116 |
| | | | September | 2.96 | .0152 |
| | | | November | 2.50 | .0129 |
| Kherson–Vorontzovka | 162 | 107.41 | March | 3.00 | .0155 |
| | | | April | 2.84 | .0146 |
| | | | May | 1.95 | .0150 |
| | | | June | 2.21 | .0114 |
| | | | July | 2.10 | .0108 |
| | | | August | 3.35 | .0170 |
| | | | September | 3.60 | .0185 |
| | | | October | 3.12 | .0161 |
| | | | November | 3.50 | .0180 |
| Kherson–Nikopol | 203 | 134.59 | April–May | 2.01 | .0104 |
| | | | June | 2.69 | .0139 |
| | | | July | 2.93 | .0151 |
| | | | August | 3.03 | .0163 |

CEREALS—Continued.

| Waterways and termini. | Versts. | Equivalent in miles. | Time of shipment. | Rate per pood (36.12 pounds). Kopecks. | Rate per pood (36.12 pounds). Equivalent in U. S. currency |
|---|---|---|---|---|---|
| DNIEPER RIVER—continued. | | | | | |
| Towed by tugs—Continued. | | | | | |
| Kherson-Nikopol (continued) | | | September | 4.29 | $0.0221 |
| | | | October | 3.93 | .0202 |
| | | | November | 4.00 | .0206 |
| Kherson-Tarasovka | 241 | 159.78 | April-May | 2.00 | .0103 |
| | | | August | 3.00 | .0155 |
| | | | September | 3.87 | .0199 |
| | | | October | 4.56 | .0235 |
| Kherson-Bielenki | 258 | 171.05 | May | 2.50 | .0129 |
| | | | July | 3.50 | .0180 |
| | | | August | 3.79 | .0195 |
| | | | September | 4.52 | .0233 |
| | | | October | 4.00 | .0206 |
| Kherson-Alexandrovsk | 285 | 188-95 | May | 2.69 | .0139 |
| | | | June | 3.34 | .0172 |
| | | | July | 3.48 | .0179 |
| | | | August | 3.44 | .0177 |
| | | | September | 4.90 | .0252 |
| | | | October | 4.61 | .0237 |
| | | | November | 5.00 | .0258 |
| Kherson-Tzarskaya | 292 | 193.80 | April | 3.00 | .0155 |
| | | | May | 2.50 | .0129 |
| | | | July | 3.50 | .0180 |
| | | | August | 4.00 | .0206 |
| | | | September | 5.00 | .0258 |
| Kherson-Snigirevka | 105 | 69.61 | April-May | 1.94 | .0099 |
| | | | July | 1.50 | .0077 |
| | | | August | 2.58 | .0133 |
| | | | September | 3.15 | .0162 |
| | | | October | 3.36 | .0173 |
| | | | November | 3.00 | .0155 |
| Kherson-Evgenievka | 105 | 69.61 | July | 1.84 | .0095 |
| | | | August-October | 3.00 | .0155 |
| | | | November | 2.82 | .0145 |
| Floating: | | | | | |
| Ekaterinoslav-Tripolie | 429 | 284.43 | October | 5.00 | .0258 |
| Ekaterinoslav-Pereslavl | 381 | 252.60 | do | 6.00 | .0309 |
| Krementchug-Khodorov | 227 | 150.50 | September | 5.00 | .0258 |
| Krementchug Rjitchev | 244 | 161.77 | do | 5.00 | .0258 |
| Krementchug-Bogun | 110 | 72.93 | May | 3.00 | .0155 |
| | | | June | 2.50 | .0129 |
| Towed by tugs: | | | | | |
| Krementchug-Romankov | 121 | 80.22 | September | 4.00 | .0206 |
| Krementchug-Orlik | 78 | 51.71 | June | 2.50 | .0129 |
| | | | August | 3.00 | .0155 |
| Tripolie-Kiev | 52 | 34.48 | April | 3.00 | .0155 |
| Kiev-Ekaterinoslav | 481 | 318.90 | May | 5.00 | .0258 |
| | | | September | 7.00 | .0361 |
| Kiev-Dnieprovsk | 480 | 318.24 | August | 7.00 | .0361 |
| | | | September | 6.00 | .0309 |
| | | | October | 7.87 | .0405 |
| Kiev Pankovka | 430 | 285.09 | September | 8.00 | .0412 |
| Kiev-Orlik | 400 | 265.20 | August | 7.00 | .0361 |
| Kiev-Koleberda | 300 | 198.90 | September | 6.00 | .0309 |
| Kiev Bujin | 255 | 169.06 | May | 6.00 | .0309 |
| | | | September | 5.50 | .0283 |
| Kiev Krasny | 201 | 133.26 | April | 5.00 | .0258 |
| Kiev-Vrokhorovka | 149 | 98.79 | June | 5.00 | .0258 |
| | | | August | 4.50 | .0232 |
| | | | September | 4.07 | .0210 |
| Kiev-Rjitchev | 78 | 51.71 | April | 4.00 | .0206 |
| | | | August | 3.50 | .0180 |
| | | | September-October | 4.00 | .0206 |
| Kiev-Tripolie | 52 | 34.48 | April-September | 3.00 | .0155 |
| | | | October | 3.50 | .0180 |
| Kiev-Bogun | 232 | 153.82 | April-August | 6.00 | .0309 |
| | | | September | 5.50 | .0283 |
| | | | October | 6.00 | .0309 |
| Mohilev-Ekaterinoslav | 1,121 | 743.22 | August | 12.00 | .0618 |
| Mohilev-Tcherkas | 839 | 556.26 | October | 14.00 | .0721 |
| Mohilev-Kanev | 779 | 516.48 | April | 12.00 | .0618 |
| Mohilev-Rjetchev | 718 | 476.03 | do | 10.00 | .0515 |
| Mohilev-Kiev | 640 | 424.32 | April-June | 8.00 | .0412 |
| Shklov-Ekaterinoslav | 1,166 | 773.06 | April | 11.00 | .0567 |

CEREALS—Continued.

| Waterways and termini. | Versts. | Equivalent in miles. | Time of shipment. | Rate per pood (36.12 pounds). Kopecks. | Rate per pood (36.12 pounds). Equivalent in U. S. currency. |
|---|---|---|---|---|---|
| DNIEPER RIVER—continued. | | | | | |
| Towed by tugs—Continued. | | | | | |
| Shklov–Kiev | 685 | 454.15 | April | 8.00 | $0.0412 |
| | | | July | 11.00 | .0567 |
| | | | October | 12.30 | .0633 |
| Orsha–Ekaterinoslav | 1,208 | 800.90 | July | 15.00 | .0773 |
| Sieversk–Kiev | 517 | 342.77 | April | 7.00 | .0361 |
| | | | June | 8.00 | .0412 |
| | | | September | 7.00 | .0361 |
| Trubtchevsk–Kiev | 637 | 422.33 | October | 11.00 | .0567 |
| Narovlia–Kiev | 244 | 161.77 | April | 5.00 | .0258 |
| | | | June | 6.00 | .0309 |
| Mozir–Ekaterinoslav | 761 | 504.54 | August | 9.00 | .0464 |
| Mozir–Krementchug | 602 | 399.13 | do | 9.00 | .0464 |
| Mozir–Kiev | 280 | 185.64 | October | 8.00 | .0412 |
| Turovo–Ekaterinoslav | 913 | 605.32 | August | 10.50 | .0516 |
| David–Gora–Kiev | 494 | 327.52 | October | 9.00 | .0464 |
| Pinsk–Tcherkasy | 806 | 534.38 | do | 8.00 | .0412 |
| Pinsk–Kiev | 607 | 402.44 | May | 10.00 | .0515 |
| | | | September | 11.00 | .0567 |
| | | | October | 12.00 | .0618 |
| Homel–Ekaterinoslav | 817 | 541.67 | July | 10.00 | .0515 |
| Homel–Kiev | 336 | 232.77 | May | 8.00 | .0412 |
| Vetka–Ekaterinoslav | 840 | 556.92 | July | 11.00 | .0567 |
| Bobruisk–Ekaterinoslav | 995 | 659.68 | April | 10.50 | .0516 |
| Bobruisk–Rjetcjev | 592 | 396.00 | do | 11.00 | .0567 |
| | | | October | 12.00 | .0618 |
| Bobruisk–Kiev | 514 | 340.78 | April–May | 9.00 | .0464 |
| | | | June | 8.00 | .0412 |
| | | | July–September | 11.00 | .0567 |
| | | | October | 12.00 | .0618 |
| DON RIVER. | | | | | |
| Towed by tugs: | | | | | |
| Rostoff–Manitchekaya | 56 | 37.13 | July | 2.00 | .0103 |
| Rostoff–Razdorskaya | 120 | 79.56 | August–October | 2.50 | .0129 |
| Rostoff–Konstantinovka | 60 | 39.78 | April | 2.50 | .0129 |
| | | | August–September | 4.50 | .0232 |
| | | | October | 4.39 | .0226 |
| | | | November | 4.50 | .0232 |
| Rostoff–Nikolayevskaya | 205 | 135.91 | September–October | 5.00 | .0258 |
| Rostoff–Romanovskaya | 257 | 170.39 | August | 3.00 | .0155 |
| | | | September–October | 5.00 | .0258 |
| Rostoff–Tsimlianskaya | 284 | 188.29 | September | 6.00 | .0309 |
| | | | October | 7.00 | .0361 |
| Rostoff–Kamenskaya | 329 | 218.13 | April–May | 4.00 | .0206 |
| NIEMEN RIVER. | | | | | |
| Floated: | | | | | |
| Jurburg–Kovno | 86 | 57.02 | September–October | 3.00 | .0155 |
| Sredniki–Kovno | 42 | 27.85 | do | 3.00 | .0155 |
| Vilkia–Kovno | 31 | 20.55 | do | 3.00 | .0155 |
| Druskeniky–Lunn | 115 | 76.24 | May | 6.00 | .0309 |
| Grodno–Lunn | 50 | 33.15 | June–August | 4.00 | .0206 |

IRON ORE.

| | | | | | |
|---|---|---|---|---|---|
| VOLGA–KAMA RIVERS. | | | | | |
| Floated: | | | | | |
| Astrakhan–Taborsk | 2,373 | 1,573.30 | May–August | 7.00 | $0.0361 |
| Astrakhan–Dobrianskaya | 2,540 | 1,684.02 | May | 6.54 | .0337 |
| | | | September–October | 7.00 | .0361 |
| Astrakhan–Ust Pojva | 2,640 | 1,750.32 | May | 7.50 | .0386 |
| | | | July | 6.60 | .0340 |
| Astrakhan–Levshin | 2,491 | 1,651.53 | May | 7.60 | .0391 |
| | | | June | 7.43 | .0383 |
| | | | July | 7.25 | .0373 |
| | | | August | 7.06 | .0364 |
| | | | September | 7.45 | .0384 |
| | | | October | 8.68 | .0447 |

IRON ORE—Continued.

| Waterways and termini. | Versts. | Equivalent in miles. | Time of shipment. | Rate per pood (36.12 pounds). Kopecks. | Equivalent in U. S. currency. |
|---|---|---|---|---|---|
| VOLGA-KAMA RIVERS—continued. | | | | | |
| Floated—Continued. | | | | | |
| Tzaritzin-Taborsk | 1,910 | 1,266.33 | May | 6.00 | $0.0309 |
| | | | October | 7.00 | .0361 |
| Tzaritzin-Dobrianskaya | 2,077 | 1,377.05 | May | 6.00 | .0309 |
| | | | September-October | 7.00 | .0361 |
| Tzaritzin-Ust Pojva | 2,177 | 1,443.35 | May | 7.50 | .0386 |
| | | | July | 7.00 | .0361 |
| | | | September-October | 7.50 | .0386 |
| Tzaritzin-Levshin | 2,028 | 1,344.56 | May | 6.74 | .0347 |
| | | | June | 7.09 | .0365 |
| | | | July | 6.49 | .0334 |
| | | | August | 6.73 | .0347 |
| | | | September | 7.29 | .0375 |
| | | | October | 7.42 | .0382 |
| Kamishin-Levshin | 1,858 | 1,231.85 | July | 7.00 | .0361 |
| Saratov-Taborsk | 1,518 | 1,006.43 | May | 6.00 | .0309 |
| | | | October | 7.00 | .0361 |
| Saratov-Dobrianskaya | 1,685 | 1,117.15 | May | 6.00 | .0309 |
| | | | September | 6.00 | .0309 |
| | | | October | 7.00 | .0361 |
| Saratov-Ust Pojva | 1,785 | 1,183.45 | May | 7.50 | .0386 |
| | | | July | 7.00 | .0361 |
| | | | September-October | 7.50 | .0386 |
| Saratov-Levshin | 1,636 | 1,084.67 | May | 6.91 | .0356 |
| | | | June | 6.69 | .0344 |
| | | | August | 6.58 | .0339 |
| | | | September | 6.93 | .0357 |
| | | | October | 7.00 | .0361 |
| Khvalinsk-Dobrianskaya | 1,472 | 975.94 | September | 7.00 | .0361 |
| Batraki-Levshin | 1,329 | 881.13 | June | 7.00 | .0361 |
| | | | October | 7.00 | .0361 |
| Syzran-Levshin | 1,339 | 887.76 | May | 7.00 | .0361 |
| | | | October | 7.00 | .0361 |
| Samara-Taborsk | 1,107 | 733.34 | May-August | 6.00 | .0309 |
| | | | October | 7.00 | .0361 |
| Samara-Dobrianskaya | 1,274 | 844.66 | May-July | 6.00 | .0309 |
| | | | September | 6.70 | .0345 |
| | | | October | 7.00 | .0361 |
| Samara-Levshin | 1,225 | 812.17 | May | 7.00 | .0361 |
| | | | July | 6.00 | .0309 |
| | | | August | 6.61 | .0440 |
| | | | September-October | 7.00 | .0361 |
| Kasan-Taborsk | 823 | 545.65 | April-July | 6.00 | .0309 |
| Kasan-Dobrianskaya | 990 | 656.37 | April-August | 6.00 | .0309 |
| Kasan-Levshin | 941 | 623.88 | April | 6.24 | .0321 |
| | | | June | 9.00 | .0464 |
| | | | July-August | 6.25 | .0322 |
| | | | September | 7.10 | .0366 |
| Towed by tugs: | | | | | |
| Nizhni Novgorod-Taborsk | 1,226 | 812.84 | April-July | 6.00 | .0309 |
| | | | October | 6.00 | .0309 |
| Nizhni Novgorod-Perm | 1,328 | 880.46 | April | 7.00 | .0361 |
| Nizhni Novgorod-Dobrianskaya | 1,393 | 923.56 | May-September | 6.00 | .0309 |
| | | | October | 7.00 | .0361 |
| Nizhni Novgorod-Pojva | 1,493 | 989.86 | May-October | 7.50 | .0386 |
| Nizhni Novgorod-Levshin | 1,344 | 891.07 | April-May | 7.04 | .0363 |
| | | | June | 6.88 | .0354 |
| | | | July | 7.12 | .0367 |
| | | | August | 6.59 | .0339 |
| | | | September | 6.81 | .0351 |
| | | | October | 7.00 | .0361 |
| Kineshma-Dobrianskaya | 1,592 | 1,055.50 | May | 7.00 | .0361 |
| Kineshma-Levshin | 1,543 | 1,023.00 | do | 8.50 | .0438 |
| Kostroma-Dobrianskaya | 1,700 | 1,127.10 | do | 7.00 | .0361 |
| Kostroma-Levshin | 1,651 | 1,094.61 | do | 8.50 | .0438 |
| Yaroslav-Taborsk | 1,609 | 1,066.77 | do | 7.00 | .0361 |
| Yaroslav-Dobrianskaya | 1,776 | 1,177.49 | May-August | 7.00 | .0361 |
| Yaroslav-Levshin | 1,727 | 1,145.00 | May | 8.50 | .0438 |
| | | | June | 9.00 | .0464 |
| | | | July | 8.76 | .0451 |
| | | | August | 8.50 | .0438 |
| | | | September | 8.58 | .0442 |
| | | | October | 8.50 | .0438 |
| Rybinsk-Taborsk | 1,696 | 1,124.45 | July | 7.00 | .0361 |

IRON ORE—Continued.

| Waterways and termini. | Versts. | Equivalent in miles. | Time of shipment. | Rate per pood (36.12 pounds). | |
|---|---|---|---|---|---|
| | | | | Kopecks. | Equivalent in U. S. currency. |
| VOLGA-KAMA RIVERS—continued. | | | | | |
| owed by tugs—Continued. | | | | | |
| Rybinsk-Dobrianskaya | 1,863 | 1,235.17 | May-September | 7.00 | $0.0361 |
| | | | October | 8.00 | .0412 |
| Rybinsk-Ust Pojva | 1,963 | 1,301.47 | May | 9.00 | .0464 |
| | | | September | 7.50 | .0386 |
| | | | October | 9.00 | .0464 |
| Rybinsk-Levshin | 1,814 | 1,203.08 | May | 8.97 | .0458 |
| | | | June | 8.50 | .0438 |
| | | | July-August | 7.00 | .0361 |
| | | | September | 9.10 | .0469 |
| KAMA RIVER. | | | | | |
| owed by tugs: | | | | | |
| Laishev-Dobrianskaya | 880 | 584.44 | August | 6.00 | .0309 |
| Tchistopol-Levshin | 749 | 496.59 | May | 6.00 | .0309 |
| Tchelny-Levshin | 611 | 405.09 | do | 6.00 | .0309 |
| Galiany-Levshin | 377 | 249.95 | June | 2.50 | .0129 |
| Galevo-Levshin | 326 | 216.14 | June-August | 3.15 | .0162 |
| | | | October | 2.50 | .0129 |
| Ufa-Levshin | 972 | 638.44 | May | 12.00 | .0618 |
| OKA RIVER. | | | | | |
| loating: | | | | | |
| Nizhni Novgorod-Dugna | 1,027 | 680.90 | April-June | 12.00 | .0618 |
| Nizhni Novgorod-Bukriev | 1,126 | 746.54 | June-July | 12.00 | .0618 |
| Dostchata-Tengushev | 248 | 164.42 | April | 5.00 | .0258 |
| Dostchata-Morshansk | 323 | 214.15 | do | 5.00 | .0258 |
| Vatashka-Tengushev | 138 | 91.49 | May | 5.24 | .0270 |
| Sasovo-Tengushev | 114 | 75.58 | April-August | 5.00 | .0258 |
| | | | September-October | 6.00 | .0309 |
| owed by tugs: | | | | | |
| Nizhni Novgorod-Dostchats | 227 | 150.50 | June | 4.00 | .0206 |
| | | | July | 4.50 | .0232 |
| Pavlovo-Dostchats | 119 | 78.90 | June | 3.00 | .0155 |
| Murom-Dostchats | 25 | 16.57 | June-July | 2.00 | .0103 |
| Dostchats-Pavlov | 119 | 78.90 | July | 3.00 | .0155 |
| Dostchats-Murom | 25 | 16.57 | June-July | 2.00 | .0103 |

(*e–g*) Prorating arrangements do not exist between water lines and ailroads. A special committee has just been appointed to establish he rules regulating the railroad and inland waterway rates and is ow engaged in this work. Under the prevailing conditions the ailroads are competing with the waterway freights by means of a navigation tariff"; that is, a reduced tariff which is applied during he navigation period.

Cereals shipped in carloads fall into the following general home ariff:

| Distances. | Rate. |
|---|---|
| to 200 versts (0.663 to 132.6 miles) | $\frac{1}{24}$ kopeck per pood and verst (12.42 mills per ton-mile). |
| 1 to 540 versts (133.26 to 358.02 miles) | $\frac{1}{24}$ kopeck plus $\frac{1}{60}$ kopeck per pood and verst (8.4 mills per ton-mile). |
| 1 to 800 versts (358.68 to 530.4 miles) | $\frac{1}{24}$ kopeck plus $\frac{1}{48}$ kopeck per pood and verst (4.8 mills per ton-mile). |
| 1 to 1,121 versts (531.06 to 749.85 miles) | $\frac{1}{24}$ kopeck plus $\frac{1}{24}$ kopeck per pood and verst (5.1 mills per ton-mile). |
| 122 to 2,779 versts (750.52 to 1,882.48 miles) | $\frac{1}{24}$ kopeck plus $\frac{1}{12\frac{1}{2}}$ kopeck per pood and verst (3.7 mills per ton-mile). |
| ver 2,779 versts | $\frac{1}{60}$ kopeck per pood and verst (5.3 mills per ton-mile.) |

In order to show how this tariff affects the water rates a comparison has been drawn between the railway rates and the water rates on the Volga River between Umet and St. Petersburg, a distance of 1,175 versts (779.02 miles). The through railway freight rate, inclusive of station charges, from Umet to St. Petersburg amounts to 22.07 kopecks (11.37 cents) per pood. If the grain is shipped by river via Saratov to Rybinsk and thence by rail to St. Petersburg the charges will be as follows: Umet to Saratov, 8.14 kopecks; Rybinsk to St. Petersburg, 13 kopecks; a total of 21.14 kopecks (10.89 cents), thus showing the small difference of 0.93 kopeck (0.48 cent) per pood.

During the navigation period one uniform rate of 19 kopecks is established for grain shipments from Kamyshin, Saratov, Volsk, Syzran, Samara, Simbirsk, and Kasan to St. Petersburg, though the distances vary greatly, viz: Saratov-St. Petersburg, 1,410 versts (934.83 miles); Syzran-St. Petersburg, 1,478 versts (979.91 miles); Samara-St. Petersburg, 1,607 versts (1,065.44 miles); Simbirsk-St. Petersburg, 1,450 versts (961.35 miles); Kasan-St. Petersburg, 1,592 versts (1,055.50 miles). These exceptional navigation tariffs render the water transportation of cereals between the above-mentioned towns almost impossible.

The railroad freight rates for cereals during the river navigation season are reduced from 3½ to 5 kopecks per pood in order to divert the goods from the waterways. But there are also reverse cases, when exceptional tariffs increase the rates, in order to impede the shipment of cereals by railroads to reach the waterway terminus. The exceptional tariff, for instance, established for the Trans-Volga branches of the Riazan Ural Railway, fixes the rate from Urbak to Pokrovskaya Sloboda, a distance of 73 versts (48.4 miles), at 3.04 kopecks (1.56 cents), instead of 2.15 kopecks (1.11 cents) of the general tariff; from Krasny Koot to Pokrovskaya Sloboda, a distance of 104 versts (68.95 miles), at 4.12 kopecks (2.12 cents), instead of 3.03 kopecks (1.56 cents), and from Erjovo to Pokrovskaya Sloboda, a distance of 160 versts (106.08 miles), at 5.70 kopecks (2.93 cents), instead of 4.71 kopecks (2.43 cents).

If grain is shipped from these places by railroad to the waterway terminus, the increased exceptional tariff is applied, and if shipped in transit by rail to St. Petersburg the cheap differential rate of the general tariff is charged.

The exceptional tariff for grain charged in competition with the Marinsk waterway system, on the line Rybinsk-Riga, a distance of 907 versts (601.34 miles), is 14 kopecks (7.2 cents), instead of 17.17 kopecks (8.84 cents) of the general tariff.

Thus we have before us a very striking picture of a whole system of complicated tariff schedules, established with a view of attracting Russia's chief products to the railroads and diverting them from the waterways, in order to increase the revenue from the former, for the reason that the majority of the railroads are owned by the State, and that the bonds of those operated by corporations are guaranteed by the Russian Government.

(*h*) There is no legislation regulating the relations between rail and inland water systems of transportation.

It is customary for shippers of goods by inland waterways to insure them, as the risk is never assumed by the carrier, consequently the freight rates are not affected.

## VII. Water-borne Traffic.

(*a*) The principal commodities moved on Russia's inland waterways are cereals, lumber, coal, naphtha and naphtha products, iron ore, salt and fish, all of which are shipped in the bulk.

(*b*) According to official statistics for 1907, the latest figures available, 198,697 vessels carried 2,198,173,000 poods (35,454,403 tons) of cargo valued at 880,048,000 rubles ($453,447,200), covering 1,725,900,000 pood-versts.

As compared with the traffic for the last five years there was a decrease of 5.7 per cent in the number of vessels, an increase of 1.9 per cent in the amount of cargo carried, and an increase of 11.1 per cent in the value of same.

The following table shows the cargo traffic on the principal inland waterways in 1907:

| | Tons. |
|---|---|
| Volga River system | 18,930,645 |
| Neva River system | 5,822,580 |
| Duena River system | 1,972,580 |
| Dnieper River system | 4,248,387 |
| Dvina River system | 1,943,548 |
| Niemen River system | 1,906,451 |
| Vistula River system | 393,548 |
| Other waterways | 236,664 |
| Total | 35,454,403 |

According to the latest report on railway traffic in 1906 the cargo carried by the Russian railroads amounted to 4,902,486,000 poods (79,072,355 tons), covering 2,242,145,895,000 pood-versts.

Official publications giving statistics of vessel movement and traffic carried on inland waterways; also railroad traffic, tonnage, and ton-mileage are only available in the Russian language and therefore not submitted with this report.

(*c*) Local traffic predominates on the important inland waterways, the character of the traffic being cereals, lumber, naphtha and naphtha products, coal, iron ore, manufactures of iron, salt, fish, building material, etc. There are no data available as to the exact proportion of the traffic for the past two or three years, but the following figures for the three years previous to, and including 1890, are given.

This data, however, which show the quantity of goods carried by waterways, are founded on official information, which is considered to be lower than the real transport. This is caused by the fact that the freight on transports by water amounts to one-fourth per cent of the value of the goods carried, but as the proprietors of such goods value them themselves, and as such valuation and quantity of goods are not verified, the proprietors of the goods often show the articles to be of less value and quantity than they are in reality.

The total amount of goods carried by the interior waterways of European Russia, not including Finland, Caucasus, and the Vistula region, on vessels and rafts, in 1907 was 2,198,173,000 poods or 35,454,403 tons, an increase from 1,100,000,000 poods in 1890, or nearly 100 per cent. The greater part of these goods, 66 per cent, were carried by the waterways which form the Volga-Neva-North-Dvina-Onega system; 28.5 per cent by the Dnieper-West-Dvina-Neman-Vistula system. By the separate basins of the Don, Dniester, and

Narova, with Lake Choudsk, 5.5 per cent, three-fifths of which goes by the Don, the balance being about equally divided by the two other rivers.

Lumber and wood materials occupy the first place as to the quantity transported by waterways. They are principally carried on rafts and form nearly the entire cargo on some rivers; thus on the Onega, 98.5 per cent; West Dvina, 98 per cent; Neman, 92.5 per cent; Vistula, 100 per cent; and on the Narova, 98 per cent of the total cargo.

Out of the total transport mentioned above, 59 per cent are carried on the Volga-Neva-North-Dvina-Onega system; 37 per cent by the Dnieper-West Dvina-Neman-Vistula system; 1.9 per cent by the basin of the Don; 0.4 per cent by the Dniester; and 1.7 per cent by the Narova.

The principal points of destination of wood and lumber transports are St. Petersburg, Novgorod, Vyshni-Volochok on the Tsna, Astrakhan, Tsaritsin, Saratov, Kazan, Nizhni-Novgorod, Yaroslav, Tver, Moscow, Archangel, Kiev, Kherson, Kovno, and Riga, through which city goods are exported.

Bread cereals also form one of the most valuable transports by water, 64.5 per cent of which is carried by the Volga-Neva-North-Dvina-Onega system; 23.3 per cent by the Dnieper-West Dvina-Neman-Vistula system. In the first of these systems cereals are sent principally from the harbors of the Volga, the Kama and its tributaries, the Soura, the Oka, and the Vologda.

The principal points of destination are St. Petersburg, Rybinsk, Nizhni-Novgorod, Yaroslav, Astrakhan, Archangel, Kherson, and Kiev.

Kerosene, naphtha, and naphtha products are transported yearly by waterways, according to the latest available statistics, to an amount averaging about 100,000,000 poods, of which 97.5 per cent is carried by the Volga-Neva-North-Dvina-Onega system. The products originate in the south and southeast of Russia and are transported to the northern cities for the most part in barges built specially for that line.

Salt, which is one of the prime articles of production in Russia, is transported on the Volga-Neva-North-Dvina-Onega system to about 88 per cent of its output; 11.3 per cent goes by way of the Dnieper-West Dvina-Neman-Vistula system. Salt carried by the first-named system is principally produced from the salt mines in the governments of Astrakhan and Perm.

Unwrought iron, steel, and tin are increasing yearly in production and forms one of the main articles of transportation on the inland waterways; 85 per cent is carried on the Volga-Neva-North-Dlina-Onega system; 12 per cent on the basin of the Don, and the balance on the Dnieper-West Dvina-Neman-Vistula system. The greater part of iron, transported by the first of these systems, comes from the Ural metallurgical works, situated in the governments of Perm, Ufa, Orenburg, and Viatka, and is sent by the Kama and its tributaries. The principal points of destination are St. Petersburg, Nizhni-Novgorod, Kasan, Tsaritsin, Saratov, Rybinsk, Yaroslav, and Samara. The transport of unwrought cast iron goes for the most part (91 per cent) on the Volga-Neva-North-Dvina-Onega system.

Stone coal is shipped to the extent of 69.6 per cent by way of the Volga-Neva-North Dvina-Onega system; 21.3 per cent by the Dnieper-West Dvina-Neman-Vistula system, and 6.4 per cent by the Don basin. The principal transports go by the Kama and its tributaries and the remaining quantity from St. Petersburg. The points of destination are the harbors of the Volga: Samara, Batraki, Kazan, and the harbors of the Neva and Izhora, and the Dnieper.

Fish, including herring, are transported to the extent of 84.6 per cent on the Volga-Neva-North Dvina-Onega system, and 12.96 per cent by the Don. The principal transports go from Astrakhan and Archangel. The greatest quantity goes from Astrakhan to Tsaritsin, whence they are shipped to other cities by rail.

Spirits are shipped to the amount of 70 per cent on the Volga system, while the remaining 30 per cent goes by way of the Dnieper.

Sugar, which forms one of the chief commodities of southern Russia, is transported on the Don, 40.7 per cent; on the Dnieper-West Dvina-Neman-Vistula system, 31.4 per cent; and by way of the Volga-Neva-North Dvina-Onega system, 27.9 per cent.

Cotton is exclusively shipped by the basins of the Volga and the Don—by the former 97.8 per cent, and by the latter 2.2 per cent. The chief cities of export are Astrakhan and Samara, and the points of destination are Nizhni-Novgorod, Yaroslav, Tsaritsin.

Flaxseed, which is also one of the large and paying crops of the southern part of the Empire, is shipped almost entirely on the Volga-Neva-North Dvina-Onega system. It is sent from the harbors of the Volga north to St. Petersburg and Moscow, and other large manufacturing cities.

Flax and tow is transported in considerable amounts over the Volga and its tributaries. The chief harbors for loading are on the Kama, its tributaries, and the North Dvina. The points of destination are St. Petersburg, Archangel, Nizhni-Novgorod, Kostroma, Kazan, and Vologda.

(*d*) The average wages paid on river steamers are as follows:

| | Per month. |
|---|---|
| Commander | $100–$125 |
| First mate | 75– 100 |
| Engineer | 60– 75 |
| Firemen | 15– 20 |
| Sailors | 10– 15 |

As aforesaid, the loading and unloading of vessels is done in the most primitive manner; peasants are employed, and their wages are from 38 cents to 75 cents per day.

## WATERWAYS IN SOUTH RUSSIA.

South Russia is in a somewhat peculiar position in having only comparatively short inland waterways. This circumstance is the natural consequence of the peculiar geographical condition of the country, owing to which all the rivers flowing to the Euxene have to pass through a somewhat low granite ridge running across from the southeastern bend of the Carpathian Mountains toward the southern extremity of the Ural Range. In most parts this ridge of gentle gradients is covered by a thick layer of fluvial and also of marine deposits on which rests some of the finest black earth which

is so famous for agriculture, but in the cut-out valleys formed by the rivers, which have pierced their way south, all the rocky formations crop out, and, being intractable, they hem the rivers in and cause rapids and cataracts, so that the upper courses of the rivers, which are frequently navigable for small craft, are during most of the year cut off from the lower parts, and in some cases only rafts of timber can be sent down during high water.

Much no doubt could be done by the agency of man to improve these waterways by creating locks at the places of those rapids, but so far nothing of that kind has been accomplished. Only palliative work has been carried out in the more easily navigable portions, such as clearing away sandbanks, deepening fairways, fixing river banks, etc.

To improve navigation it would also be of the greatest importance to create large reservoirs to retain much of the spring water now running to waste and to use it to tide over the long and troublesome period of low water; but all that is also left to the future.

Meantime, there is steam navigation in the large rivers of south Russia only for perhaps a couple of hundred miles from the estuaries upward. As a result of the difficulties of navigation, and also as a consequence of the total exclusion of all foreign shipping from the coasting trade and from the river navigation, freights are abnormally high, and consequently by the river Dnieper and by the Black Sea from Alexandrovsk to Odessa, a distance of nearly 200 miles, from 5 to 8 kopecks per pood are charged, or $1.43 to $2.29 per short ton. Nikopol-Odessa and Kakhovka-Odessa, by that same route, but somewhat shorter in distance, pays from 4 to 7 and 3 to 5 kopecks, respectively, or $1.14 to $2 and 85 cents to $1.43 per short ton, respectively.

From Kherson to Odessa, a distance of about 100 miles, freight costs from 2 to 3 kopecks per pood, or 57 to 85 cents per short ton. Thus it is found that the average rate of freight from Odessa to Alexandrovsk is equal to about the average rate of freight from Odessa to London.

Such heavy rates in water carriage naturally hamper all development of trade and industry; yet, with the existing difficulties to navigation, even the abnormal rates are not always remunerative to the owners of the small craft concerned. This year the water fell so low in the Dniester and left so little on the crests of the sandbanks that all navigation was stopped there for months at a time.

The control of inland navigable waters is in the hands of functionaries at Ekaterinoslav, Tiraspol, and other places. These officers send in separate reports to the Kiev district officer, who in turn renders general reports for the sole use of the ministry of ways and means of communication and to the ministry of finance at St. Petersburg. The staff has purely administrative functions and has nothing to do with capitalization of navigation corporations, regulation of freight rates, or financial and commercial matters. Their work is limited to the maintenance of and improvement of the waterways, their proper markings, and reporting.

In this district the matter of utilization of water power is still in its infancy. Nearly all of the improvements as regards the means of water transport are effected by the Government and by Government funds, and through officials of the State.

Upon all of the rivers sailing vessels are being rapidly superseded by steam, and timber rafting by carriage of sawed lumber in barges, timber more than often being cut up where it is felled. All river craft are of light draft, since the water in most cases is shallow and the sand banks numerous, so much so, in fact, that navigation is impeded or fully interrupted during low-water seasons.

There are no canal or waterway improvement companies.

In the matter of ownership and management of carrying vessels there are large companies and sometimes combines. Vessels are scarcely ever owned by railroads or producing concerns. The volunteer fleet at Odessa is owned and managed by the Government. It was created out of public donations during and after the Russo-Turkish War. Towing monopolies are, as such, unknown, although sometimes some firm really has a monopoly at some place or places where there is no opposition or competition.

Inland waterways and all connected with them are in the hands of the Ministry of Ways and Means of Communication, while seaports and harbors and all pertaining to them are managed by two distinct staffs, "administrative" and "technical."

Except in the estuaries, the terminal facilities on the rivers which admit ocean-going craft are somewhat primitive, except in central and eastern central Russia where there are a few elevators. In this district elevators are only located at the seaports.

There are no canals in this district, although there are important channels in the estuaries of the Bug, Dnieper, and Danube, cut to admit large sea-going craft. In this manner Nicolaiev and Kherson have been opened to ocean traffic. The funds for the completion of the above works were provided by the Government and no tolls are charged. Carrying rates, except in the case of large companies, are a matter of more or less of agreement and are affected by the relations between supply and demand.

## RIVERS IN EASTERN SIBERIA.[1]

### I. Public Supervision.

(*a*) Supervision over navigable rivers in eastern Siberia is under the control of the Central Government, exercised by a committee called administration of the water communications of the Amur Basin.

(*b*) (1) The powers and duties of this committee do not affect the capitalization of navigation corporations, and they have no supervision over the corporations except that the latter pay a business license, and the committee have power at any time to inspect the vessels and machinery.

The committee have no power over freight rates, such being a matter of private agreement among the steamship companies and shippers.

It is the duty of the committee to make reports on the amount of freight carried and the traffic in general, but not on the business operation.

The maintenance and improvement of channels is entirely in the hands of the Government and consequently subject to the advice of

[1] There are no canals in this part of the Russian Empire.

the committee, whereas the maintenance and improvement of docks and terminal facilities is in private hands, with the exception of the city piers at Nicolaevsk, where it is subject to the control of the municipality, and the railway terminal at Habarofsk, which is under the control of the Government railway.

One of the main duties of the committee is to collect statistics on traffic, movement of vessels, etc. These statistics are compiled from shipping lists and clearance papers and are published in book form by the Central Government.

## II. Waterway Improvements.

(*a*) The fall of the Amur River is not sufficient to develop water power, and consequently nothing has been attempted in this direction.

(*b*) Canals have never been built in eastern Siberia and the improvements to the channels of the Amur River and tributaries have not been extensive. The only improvements that have been made, or are being made, are under the control of the Central Government and consist of dredging operations. Two large dredgers keep the channel open on the lower Amur near Nicolaevsk, and two dredgers are at work at the junction of the Zeia and Amur Rivers in the vicinity of Blagoveschtchensk. The dredged material is disposed of by means of tugs and barges.

## III. Floating Equipment.

(*a*) 1. Nearly all the freight on the Amur River and tributaries is carried in barges towed by river steamers and tugs. The Amur Trading & Steamship Co. carry no freight on their steamers, but tow from one to three barges, reserving the steamers for passengers and mail. A few steamers are built for carrying freight in addition to towing barges.

2. There are no self-propelled barges, and all are either towed by the river steamers or steam tugs. On the lower Amur and the Sungaric Rivers a small amount of cargo is transported by Chinese junks, but this is of little importance.

3–4. There are about 280 private-owned vessels on the Amur River and its tributaries, 18 gunboats and 8 gunboats in the course of construction. The Government owns 9 side-wheeled tugs, varying in size from 100 to 900 indicated horsepower, and 5 propeller tugs, from 20 to 50 indicated horsepower, and in addition to this there are 3 motor boats of 50 indicated horsepower each, all owned by the Government and used to haul the dredges working on the Amur River and in addition are used by the officials.

The 280 private-owned vessels, with a gross indicated horsepower of 70,000, may be classified as follows:

Four steel-propeller steamers, 50, 100, 200, 300 indicated horsepower.

One hundred and forty steel side-wheel steamers from 100 to 800 indicated horsepower, with an average of 350 indicated horsepower, and drawing from 1½ to 4 feet of water. The length of the largest of these steamers is 262 feet, with a 28-foot beam, and the smallest is 100 feet in length, with a beam of 18 feet.

One hundred and twenty-four side-wheel wooden steamers from 60 to 400 indicated horsepower, averaging 250 indicated horsepower and with a draft of from 2 to 6 feet. The largest of this type is 180 feet long, with a 36-foot beam, and the smallest is 75 feet long, with a 15-foot beam, or an average of 150 feet long, and 25-foot beam.

Twelve side-wheel wooden steamers from 50 to 500 indicated horsepower, averaging 100 indicated horsepower and drawing from 1½ to 3 feet of water. The largest of this class is 150 feet long and 20-foot beam, and the smallest 100 feet long and 15-foot beam.

5. To show the average cost of the various types of boats in use on the Amur River, the following three steamers have been chosen:

Steamship *Boris*, steel side-wheeler, 600 indicated horsepower, 130,000 rubles ($66,950); steamship *Hlopes*, wooden side-wheeler, 200 indicated horsepower, 60,000 rubles ($30,900); steamship *Monomach*, wooden stern-wheeler, 400 indicated horsepower, 100,000 rubles ($51,500).

6. With the exception of a few large stern-wheelers, all the self-propelled vessels on the Amur River are either side-wheelers or propeller steamers. On the Zeia and other small tributaries of the Amur shallow-draft vessels of the stern-wheel type are in general use.

7. The fleets of barges on the Amur River consist of about 500, equally divided between the steel and wooden types. The steel barges have a capacity of from 18,000 to 50,000 poods (290 to 800 tons), with an average of 25,000 poods (400 tons). The draft is from 4 to 5 feet, but the average would be slightly over 4 feet, and the length and beam varies between 175 feet by 25 feet to 246 by 36 feet. The wooden barges have a capacity of from 10,000 to 32,000 poods (160 to 515 tons) with an average of 20,000 poods (320 tons). The draft is from 3 to 5 feet, with an average of 4 feet, and the length and beam from 125 to 25 feet to 180 by 36 feet. The price of a 50,000-pood (800-ton) steamer, steel, would be 50,000 rubles ($25,750), and the price of a 30,000-pood wooden barge would be 16,000 rubles ($8,240).

8. The types of boats build for transportation purposes on the Amur and its tributaries are all adapted to low-water stages.

## IV. Ownership of Vessels and Business Organization.

(*a*) There are no waterway improvement companies on the Amur River or its tributaries, all such work being carried on by the Central Government.

(*b*) In the fall of 1908 a combination was effected between the various navigation companies operating steamers on the Amur River between Nicolaevsk and Stretensk, each company having one or more steamers. The consolidation was formed solely for the purpose of keeping up freight rates with a view to monopolizing the entire transportation business of the Amur River. As far as is known no detailed agreement was entered into, but there was a mutual understanding. The organization competes successfully with the Amur Trading & Steamship Co., the latter being subsidized by the Russian Government for carrying mails, on the condition that the steamers carry out a prearranged schedule as to sailing dates, to which they must strictly adhere. In addition to this, special transportation rates are given to naval and military officers, Government officials,

soldiers, and army and navy stores, these rates being lower than the regular freight and passenger rates. Due to the fact that these steamers must leave on scheduled time, they can not wait for freight as the other steamers can, and consequently lose much business. If, for example, an ocean steamer arriving at Nicolaevsk must unload immediately and it happens to be the day of departure of a steamer belonging to the Amur Trading & Steamship Co., the latter being compelled to leave on schedule time, must go without cargo, whereas the competitor can wait as many days as necessary in order to take full cargoes. As a result the steamers of the organization can command higher freight rates.

(*c*) No vessels are owned by railways or other concerns or companies solely for the transportation of their own freight or products. However, a flour-mill operator owns two steamers, which make regular trips during the autumn, carrying flour to Harbin, and on the return trip carrying wheat, these being products from and for his flour mill in Blagovechensk. During the balance of the open season, the spring and summer months, these two vessels are subject to the rules of the organization as to freight rates.

There have been some instances of private-owned steamers making trips up the Zeia River and furnishing the gold mines with supplies, but these runs have been discontinued and the vessels are now used as regular transportation boats.

(*d*) There are no fleets of merchant vessels or other transportation vessels owned by public officials, as it is unlawful for such authorities to enter into, or be connected with, any business enterprise with which they might come in contact in their capacity as public officials.

(*e*) That a combination has been effected by certain transportation companies for the purpose of controlling towing and freight rates, and if possible, of monopolizing the business, is shown by the following example: In the autumn of 1908, H. H. Kramer, a merchant of Habarofsk, had 6,000 poods (about 100 tons) of piece goods that he wished to ship to Blagovechensk. This consignment reached him shortly before the close of navigation, and the freight rate was 20 kopecks a pood ($0.103 per 36 pounds). The organization, knowing that it was imperative for him to have the goods in Blagovechensk for the winter, and, as their steamers were the only ones in port, and as the river would soon freeze over and navigation would cease, increased their freight rates to 35 kopecks per pood, ($0.18 per 36 pounds). There were no more vessels of the Amur Trading & Steamship Co. scheduled to made the run that year, it being the end of the navigating season, and application to the various vessels then in the Habarofsk showed that each had increased the freight rate to 35 kopecks, indicating clearly that a combination had been effected controlling freight and towing rates on the Amur River.

## V. Terminal Facilities.

(*a*) The striking physical features of the river terminals are the lack of loading and unloading facilities. At Nicolsevsk there are six wooden T piers.

These piers are owned by the municipality of Nicolsevsk and are rented annually at public auction either to individuals or companies. At Habarofsk the river banks are kept intact by a log retaining wall,

alongside of which are moored floating wharf boats; this arrangement applies equally to Blagoveshtchensk and Stretensk. At intermediate stations along the river the steamers moor as close as possible to the shore (about 40 feet), and by means of their own boats, which they anchor near the shore, they erect temporary pontoon bridges for loading and unloading the cargo.

(*b*) All loading and unloading of steamers and barges is done by hand, the laborers usually being Chinese coolies. The freight is carted in wagons to the water's edge, unloaded by hand on the floating wharf boats, and from these into the barges or steamers.

(*c*) At Habarofsk the railway tracks are so located as to permit direct transfer from the railway cars to river barges or steamers. The Ussuri Railway tracks run along the edge of a cliff above the river, and freight is taken from the cars and shunted into the barges by means of ordinary wooden slides. Little freight is unloaded in the opposite direction, and it is necessary to carry the cargo up the incline by hand.

The same conditions apply to Stretensk, but here the railway is on the opposite side of the river to the town, and after loading into barges the cargo is ferried across the river by primitive ferries propelled by force of the current.

(*d*) The piers at Nicolsevsk, described in the answer to question (*a*), belong to the municipality and the terminal at Habarofsk belongs to the government railroad. The land fronting the river at all other terminals is owned by the various municipalities and is rented annually, but the floating wharf boats, which form the actual terminals, are owned by individuals or companies. The rents for the river-front land belong to the municipalities.

(*e*) The piers at Nicolsevsk are owned by the municipality and are rented by annual contracts to the steamship companies and are used by their own boats, so there are no docking fees. At other points where floating wharf boats are used the wharf boats are owned by steamship companies, and the same conditions apply.

At Iman there is a terminal charge of 4.50 rubles ($2.32) for switching each car from the railway freight yards to the steamship landings. At Habarofsk for the same service 1.50 rubles ($0.77) is charged per car. These charges are minimum, and are collected whether the cars are 900 or 700 pood capacity, and whether they are loaded fully or not.

Storage charges are a matter of agreement. At Habarofsk these charges are as high as 1 kopeck a pood per month, if no previous arrangement has been made, but by agreement this charge can be reduced to one-half of 1 kopeck or one-third of 1 kopeck per month.

There are no published lists of terminal charges available.

## VI. Tolls and Freight Rates.

(*a*) No tolls are charged on rivers, with the exception of the annual license, which is merely a permit to do business, and this tax is based on the size of the steamer. The steamship owners are required to allow the government officials (inspectors) to examine their boats, boilers, and machinery at any time.

(*b*) The principal element that enters into towing rates is the amount of commodity to be transported, and is fixed by private

agreement only. The quality of commodity offered affects the rate only as to whether it is heavy or light, etc.

(*c*) The transportation companies have the schedules of freight rates, but these are not adhered to, and all freight arrangements are made by private agreement or by bargaining at time of shipment. Most of the large firms who make regular shipments enter into agreements with the transportation companies during the winter, and the rates are fixed for the next open season. The principal element that enters into these agreements is the amount of freight which they expect to ship, and a flat rate is usually agreed upon from one terminal to another.

Example: The International Harvester Co. of America makes a yearly freight agreement with the transportation companies who handle their freight from Vladivostok to Blagoveshtchensk at a flat pood rate. In 1909 this rate was 52 kopecks irrespective of the quantity shipped at any one time. At the time of fixing this rate the International Harvester Co. expected to forward about 50,000 poods (about 800 tons), but no guaranty was given as to the quantity. In 1909 this rate was reduced to 40 kopecks per pood on about the same quantity of goods.

The freight rates are unstable and vary with traffic exigencies. In the spring of the year the rates are much lower than in the summer and fall months, and this is affected by the number of barges that have been tied up the previous winter at Habarofsk, and upon the amount of accumulated freight at that port which is to be transported up the river; i. e., the greater number of barges and the lesser amount of freight produces a low freight rate. In 1908 the freight on agricultural machinery to Blagoveshtchensk from Habarofsk was 7 kopecks a pood, the rate on the same quantity of machinery over the same haul in the summer months averaging 20 kopecks a pood.

(*d*) 1. The freight rates are fixed in the proportion of the distance of haul.

2. The quantity of the commodity to be shipped usually enters into the freight rate, but if individual shippers have a considerable quantity of freight to be forwarded they usually have some large firm which has an agreement with the transportation company for a flat rate to handle their shipments for them.

Example: If the shipper has 1,000 poods of freight to ship from Habarofsk to Blagoveshtchensk during the summer months, and the steamship companies were not rushed with freight, the rate would probably be about 15 kopecks per pood; however, if, instead of the 1,000 poods, the quantity to be shipped was 50,000 poods and would require several barges, the rate at the same time of the year and under the same conditions would be about 12 kopecks per pood.

3. Speed is not a factor in the making of freight rates on these waterways, and the steamship companies do not hold themselves responsible for delays in transmission.

4. The character of the commodity affects the freight rates when the shipment is of a perishable character or liable to be damaged by water. Such cargo as piece goods, flour, twine, provisions, etc., must be stored in the hold of barges or steamers and protected from water, and as this means extra handling and more time in loading and unloading, the freight rate is higher.

Machinery, iron, timber, etc., which can be stored on deck, are shipped at lower rates.

Example: If the rate on agricultural machinery from Habarofsk to Blagoveshtchensk is 15 kopecks per pood, the rate on binder twine for the same distance and under the same conditions would be 20 kopecks per pood.

(*e*) No prorating arrangements exist between water lines and railways, the tariffs on the latter being fixed and published, whereas with the water lines it is necessary to make special arrangements. Forwarding companies, by adding the amount of the railway freight and handling charges, quote a through rate, being able to do so by having flat rates with the shipping companies.

(*f*) With the exception of the tariff on grain and flour, as explained in the answer to the following question (*g*), the railway freight rates are affected by water companies. In the answer to the following question (*g*) a comparison has been drawn between the freight rates on machinery between Iman and Habarofsk, showing that the water route has greater competitive power than the railway.

The through freight rate on the Government owned railroad from Vladivostok to Chita, a nonwater competitive point, a distance of 1,370 miles, is 98 kopecks per pood on machinery. In competition with this, a combined water and railway rate from Vladivostok to Habarofsk, a distance of 477 miles on the Ussuri Railway; from Habarofsk to Stretensk, a distance of 1,410 miles by river; and Stretensk to Chita, a distance of 240 miles on the Trans-Baikal Railway, is 80 kopecks per pood, including the transshipment expenses, and this despite the fact that the Ussuri and Trans-Baikal Railways are also owned by the Government. The total distance of the combined rail and river route is 2,127 miles, or 757 miles more than the direct rail route between Vladivostok and Chita.

(*g*) There is practically no competition between the railway and water lines. The only absolute parallel line is between Habarofsk and Iman, a distance of 220 miles by rail and 262 miles by river. The railway in question is owned by the Government and the freight rates are published, whereas with the steamship lines the rates are charged according to condition. In the above cases the railway freight rate on shipments of machinery is nearly 13 kopecks per pood against 7 kopecks per pood by river. This calculation, however, applies only when the cases of machinery do not exceed 15 poods in weight each. Heavier cases pay higher river rates. This river rate applies only for transportation charges, and does not include loading or unloading or other terminal charges. During the period of open navigation the tariff on grain and flour on the Chinese Eastern Railway and the Ussuri Railway from Harbin to Habarofsk is reduced from 5 to 6 kopecks per pood in order to compete with the river steamers. This is the only case in which the Chinese Eastern Railway reduces the freight rates in order to meet river competition, and from no other point except Harbin to Habarofsk would this competition be of any consideration. The water freight rates from Harbin to Habarofsk on the Sungarie and Amur Rivers average between 10 and 15 kopecks per pood, depending upon the quantity of freight offered and the state of water in the river.

(*h*) There is no legislation regulating the rates between rail and water lines. The railway rates are fixed and published and are not lowered in order to compete with water rates.

It is customary for shippers by inland waterways to insure their goods, as the risk is never assumed by the carrier. Goods so shipped

are generally insured, as the risk is very great, due to the number of accidents to the steamers and the bad methods of handling the cargo. A blanket-insurance policy is issued for this character of business, and an average rate from Vladivostok to Blagoveshtchensk would be about one-half of 1 per cent. This insurance covers all accidents that may happen to the cargo while in transit. The usual rate from Habarofsk to Blagoveshtchensk, which is an all-water route, is about one-third of 1 per cent. The steamship companies act as agents for the insurance companies, the Russian Transportation & Insurance Co., of St. Petersburg, being the principal insurance company handling this business. The steamship companies are not liable for any accidents to freight except what is insured, and, as the insurance is carried by the shipper, it does not affect the freight rate.

## VII. Water-Borne Traffic.

(*a*) The principal commodities moved on the Amur River are flour, wheat, oats, iron and machinery, salt fish, and tea, all of which is package freight, with the exception of a small quantity of wheat, firewood, and coal, which are shipped in bulk.

(*b*) Statistics of vessel movements and traffic carried on inland waterways and railroad traffic tonnage and ton mileage are not available.

(c) The main traffic down the Amur River to Nicolaevsk is flour, about 24,200 tons annually; also wheat and oats, all of which may be classed as local traffic. The main character of traffic up the Amur River is fish, iron, machinery, and tea. The former would come under the head of local traffic, and the three latter are imported by sea to Nicolaevsk and transported up the river. The tea and fish are principally for interior points of Siberia. The traffic on the Sungarie, a tributary of the Amur, consists of wheat, beans, bean oil, and cattle, all of which would come under the heading of local traffic. With a small exception of Chinese goods, there is practically no return freight up the Sungarie River. The character of the traffic on the Zeia River, another tributary of the Amur, is gold from the various mines located in this district, and the return freight consists in the main of provisions for the gold-mining companies.

The traffic on the Argun and Shilka Rivers consists almost entirely of live cattle and sheep, which are shipped in large quantities to various parts of Eastern Siberia.

(*d*) The following table will show the average wages paid on river steamers:

| | Per month. | |
|---|---|---|
| | Rubles. | Equivalent in U. S currency. |
| Commander | 250 | $123.75 |
| First mate | 200 | 103.00 |
| Engineer | 150 | 77.25 |
| Fireman | 40 | 20.60 |
| Sailors | 25 | 12.88 |

All river steamers are officered by Russian subjects, and the same rule applies to Government vessels; but on private-owned boats no distinction is made between Russians, Chinese, and Koreans for firemen and sailors.

The loading and unloading of freight at the various stations along the Amur River is done by labor societies. They elect a member to make contracts with the several steamship companies at a flat rate per pood, and money received in this way is equally divided among the laborers.

The rate at Nicolaevsk and Habarofsk is 1½ kopecks per pood, and at Blagoveshtchensk and Stretensk it is about 2 kopecks.

## RIVERS AND CANALS IN THE BALTIC PROVINCES AND ADJOINING TERRITORY.

The waterways which more or less serve for the transportation of merchandise in the Baltic Provinces and adjoining territory consist of the Rivers Dvina (length, 620 miles, of which 360 miles are navigable), the Kurländische (Courland) Aa (length, 125 miles), the Livländische (Livonian) Aa (length, 170 miles), and of the two canals, the Dvina-Aa Canal (length of three sections, 4.62 miles), connecting the Dvina with the Livländische Aa, and the Beresina Canal (length, 7 miles), connecting the Dvina with the Beresina River.

Before the construction of the different railroad lines from the interior of Russia to Riga the waterways represented practically the only means of transportation to this port. However, when the railroads were completed, and, in particular, in 1861, the line on the right bank of the Dvina between Witebsk and Riga and the connecting lines reaching as far as the rich grain districts of the Volga, the importance of the River Dvina as a road of communication was reduced to a minimum for all products, with the exception of timber. The decrease of the water-borne traffic is clearly shown by the following: In 1848 the number of "strusen"—a flat-bottom wooden barge with a loading capacity of about 225 tons—floated down the river was 1,240; from 1866 to 1877 the average number per annum did not exceed 350; and in 1908 only 8 barges were counted. The decline in the traffic on the Dvina is also attributed to the fact that no serious attempt was ever made to render the river navigable for large-sized vessels above the city of Riga as well as to the failure in endeavoring to regulate the lower section from Jakobstadt to Riga, which, in a length of 96 miles, is intercepted by rapids, only permitting downstream traffic during high water in spring.

The Livonian and the Courland Aa serve almost exclusively for the rafting of timber, the traffic on the former river having gained in importance since the opening of the Dvina-Aa Canal, while the latter since the completion of the Mitau Mosheiki railroad line can not claim attention as a profitable artery of communication for the trade of the port of Riga.

The Beresina Canal connecting, as stated, the Dvina with the River Beresina at a point about 50 miles below Witebsk was constructed during the years 1797 to 1804. The maintenance of this canal, which served for rafting timber, soon proved difficult during periods of drought. About the year 1870, when general attention was directed toward the improvement of the waterways in

Russia, the Beresina Canal System was carefully examined, with the result that it was not deemed profitable to deepen its bed on account of the scarcity of water.

At the present time the railroads carry over 75 per cent of the merchandise handled at Riga for export, excepting, of course, timber. The following table clearly illustrates the predominance of the railroad over the water-borne traffic:

*Total quantity of goods carried to Riga.*

| | | Average per annum. | | 1907 |
|---|---|---|---|---|
| | | 1896–1900 | 1901–1905 | |
| Miscellaneous goods: | | | | |
| By rail | tons | 875,776 | 1,051,130 | 1,146,759 |
| By the Dvina | do | 32,233 | 22,368 | 36,859 |
| By the Courland Aa | do | [1] 174,562 | [2] 119,955 | [3] 92,425 |
| By sea, coastwise | do | 78,464 | 111,851 | 167,387 |
| Total | | 1,161,035 | 1,305,304 | 1,443,430 |
| Timber: | | | | |
| Down the Dvina | pieces | 6,962,588 | 6,267,669 | 6,128,193 |
| On the Courland Aa | do | 187,064 | 1,229,585 | 2,124,514 |
| On the Livonian Aa | do | 660,779 | 474,998 | 1,007,718 |
| Total | | 7,810,431 | 7,972,252 | 9,260,425 |

[1] Including 111,425 tons of bricks.
[2] Including 164,331 tons of bricks.
[3] Including 91,559 tons of bricks.

As a further illustration of the marked predominance of the railway over the water-borne traffic, the following comparative table, embracing seven of the principal commodities carried to and from Riga during 1907, will be of interest:

*Comparative table of rail and water-borne traffic to Riga, embracing five of the principal commodities.*

| Articles. | Rail. | Dvina. | Courland Aa. | Coastwise. | Total. | Exports from port. |
|---|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| Flax and tow | 94,278 | 577 | ..... | 351 | 95,206 | 99,886 |
| Barley | 17,496 | 304 | ..... | 246 | 18,046 | 5,411 |
| Oats | 21,695 | 840 | ..... | 4,774 | 27,309 | 3,196 |
| Rye | 39,373 | 133 | 595 | 148 | 40,249 | 14,938 |
| Linseed | 36,826 | 4,333 | 271 | 1,232 | 42,662 | 29,487 |
| Total | 209,668 | 6,187 | 866 | 6,751 | 223,472 | 152,918 |

*Comparative table of rail and water-borne traffic from Riga, embracing the two principal commodities.*

| Articles. | Rail. | Dvina.[1] | Courland Aa. | Coastwise. | Total. | Imports into the port. |
|---|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* | *Tons.* |
| Coal and coke | 59,273 | ..... | 5,542 | 1,093 | 65,908 | 534,293 |
| Fertilizers | 51,310 | ..... | 1,383 | 1,128 | 53,821 | 59,283 |
| Total | 110,583 | ..... | 6,925 | 2,221 | 119,729 | 593,576 |

[1] No statistics kept on account of smallness of traffic.

PUBLIC SUPERVISION.

The supervision over navigable streams and canals is exercised, under the control of the ministry of ways and communications, by district inspectors and their subordinates, whose duties are to draw up plans and estimates of important repairs and new construction of canals, bridges, locks, etc., for submission to the ministry. Upon approval of such plans, the works are executed by the engineers attached to the inspector's staff. The headquarters for the inspection of the waterways in the Baltic Provinces are located at Vilna, in the government of Vilna.

In Bieloje, a town on the upper Dvina, an advisory committee to the inspectors of waterways has been appointed and consists of three merchants engaged in the shipment of goods by water to the port of Riga.

No special control is exercised by these officials over the capitalization of navigation corporations nor over the reports of operation, excepting the usual supervision to which all business corporations are subjected for the assessment of taxes. These taxes consist principally of a tax on the capital and a tax on the net revenue, the latter tax having been inaugurated in 1906. The capital of a corporation can not be increased without duly notifying the Central Government.

The technical supervision over the lower reaches and estuaries of important rivers has been transferred to the ministry of trade and industry, within limits determined by the local committees on harbors, on approval by the Central Government.

At the port of Riga the works connected with the maintenance and improvement of the river channel, quays, wharfs, docks, bridges, etc., are executed since 1902, when the levying of port dues was taken over by the State, with funds supplied by the Central Government. The estimates and plans for such improvements are prepared by the port engineer office of the Riga Chamber of Commerce for submission to the Central Government.

The administration of the port of Riga has during some time back undergone various transformations, through which the obligations and competence of the earlier municipal self-administration were more or less taken over by the Government. In 1902 the levying of the port dues, as above stated, passed over to the State, and in 1903 the administration of the port was placed under the control of a new Government institution, the "general administration of commercial navigation and harbors." The chief director of this institution was invested with the powers of the ministers of finance and public works in all questions relating to navigation and harbors. Port commanders, who were preferably obliged to be naval officers, were appointed for the separate ports. Since that time the Riga harbor board (Rigaische hafenbehörde), consisting of the local representatives of the three ministries of commerce, ways, and communications, and of the interior, the mayor of the city, the president of the exchange committee (chamber of commerce), and two merchants, holds its sittings under the presidency of these port commanders.

When the general administration of commercial navigation and harbors was discontinued, in the year 1905, its different departments were placed under the newly created ministry of trade and industry. This change did not affect the administration of the port of Riga.

Although from the time the State took over the port dues the exchange committee and the city authorities lost the right they had formerly possessed of disposing of these dues at their discretion, yet they continue to retain the confidence of the Government, which intrusts them with a large part of the harbor works, and makes the necessary appropriations out of a special fund which is derived from three-fifths of the total port dues. The exchange committee, which owns all the dredges, barges, and tugs, has, since 1818, undertaken the maintenance and deepening of the river channel from Riga to the sea (a distance of 8.2 miles), the Government making liberal allowances for this work. During 1908, 260,000 rubles ($133,900) were allowed for dredging, etc., thus permitting the river channel to be given a depth of 24 feet and of 25 feet at its mouth.

The city is allowed sufficient funds for works within the city limits, especially for the improvement of streets regarded as belonging to the harbor and for the maintenance of the regulating works of the Dvina.

### TERMINAL FACILITIES.

The main characteristics of the Riga Harbor are a line of wooden and stone dams and granite quays extending along both banks of the River Dvina for a distance of 23.10 miles to its mouth, and serving as a port for seagoing and coasting vessels and as a protection to the adjacent lowlands against floods. Along these banks certain arms and creeks have been utilized to form winter harbors and points of discharge for small vessels engaged in the coasting trade and for the flat-bottom river boats. The largest of these creeks at the river's mouth forms an outer and inner harbor. The latter, comprising an area of about 66,000 square fathoms, is connected by rail with the main railroad system and provides shelter for about 100 vessels during the winter months. The winter harbor is equipped with a slip dock, which was built in 1864. The inclined plane of this dock is 700 feet long and is provided with four lines of rails. The dock is worked by steam power and cost $43,000; it can dock ships up to 1,000 tons and 200 feet long.

A floating dock is stationed at the mouth of the river in the Bolderaa Harbor; it was built by the Howald Works in Kiel, Germany, and was delivered in 1898. The dock consists of two sections, 160 and 100 feet long, with a lifting power of 1,410 and 940 tons, respectively. The two sections together can raise a ship of 2,350 tons displacement, or of about 3,000 register tons. The dock is 55 feet wide (inner width) and 72 feet broad. The larger section rests on three, the smaller on two pontoons, which are connected by lateral chambers 22 feet in height. The engines are of 36 indicated horsepower and are coupled direct to centrifugal pumps with tubes of 14.6 inches diameter. The dock can be pumped dry in two hours. From August, 1898, to December, 1907, the dock was used by 771 vessels.

Among the workshops for shipbuilding and repairs may be mentioned: The shipbuilding yards of Lange & Sohn, employing about 1,600 workmen. These works turn out river steamers, dredgers, icebreakers, and small war vessels.

The Bolderaa Maschinenfabrik, established by the Riga exchange committee for the repairs of dredgers, lighters, tugs, etc., is employed chiefly for repair work.

Besides these there are along the harbor a few other small repairing shops and building yards for shipping.

The mechanical appliances in the harbor consist of a 66-ton floating crane, built by the Kramartorsky Metallurgical Co. at Lange & Sohn's shipyards, and costing $44,000; a 25-ton hand crane, built by the machine works of Wöhrmann & Sohn, in Mühlenhof, near Riga; a 10-ton electric crane, from Mohr & Federhaff, of Mannheim, Germany; and a 25-ton hand crane, supplied by John Taylor, of Birkenhead, England.

The charge for the use of the floating crane is $3 per hour, the minimum charge, exclusive of the moving, $12. Use of electric crane 2.5 kopecks (1¼ cents) per pood (36 pounds). It is admitted, however, that the Riga Harbor is inadequately equipped with cranes. The increasing cost of labor and the growing necessity of expediting the loading and unloading of vessels has caused the exchange committee to urge the purchase of an additional number of electric cranes, and also to prepare plans for the reconstruction and extension of the customhouse import quay and of the warehouses on the export quay.

Railroad tracks are located along the export and customhouse quays on the right bank of the Dvina. Branch lines extend to the port of Bolderaa at the mouth of the river, and to the Mühlgraben Harbor. All these tracks are connected with the central freight station, thus permitting direct transfer between railroad and water lines.

The docks, wharves, and piers in the harbor of Riga, as well as the railroad system are the property of the Government.

ACCOMMODATIONS FOR STORING MERCHANDISING IN THE HARBOR.

The smallest part of the goods brought into Riga is transferred direct from the land to the sea route and vice versa: the bulk requires warehousing, the duration of which depends upon economic and commercial conditions. The accommodations for storing merchandise are good: the warehouses are fireproof and provided with modern equipments. The most striking structures are the grain elevator and the cold storage houses. The grain elevator is 255 feet long and 78 feet wide. The two ends inclose 72 silos of 330,000 poods capacity (1 pood, 36 pounds). The storing loft can hold 2,800 tons of grain distributed 6 feet deep, so that in all about 8,350 tons of light grain and about 12,500 tons of heavy grain can be stored. At four recipients 135 tons of grain can be raised, cleaned, weighed automatically, and distributed per hour.

The cold storage houses were erected and are owned by an English company. Large quantities of butter from Siberia, eggs, game, and poultry destined for export are stored in this building. The establishment has largely contributed to the development of the export of perishable products from this port.

*Docking charges.*—For the use of the floating dock, described in an earlier part of this report, the charges are as follows:

Example 1. For a vessel from 200 to 250 registered tons, docking and undocking, $46.35 and $12.85 per day.

Example 2. For a vessel of 1,000 registered tons, docking and undocking, $90 and $44.30 per day.

Example 3. For a vessel of 2,000 registered tons, docking and undocking, $128.20 and $90.65 per day.

### PORT DUES, TOLLS, AND FREIGHT RATES.

Upon the reorganization of the port dues in the year 1902, all the charges imposed on ships and goods in harbors were suspended, with the exception of those which constituted payment for services rendered, as for example for pilots. In place of the different charges a pood rate was fixed for all goods passing through the port, as well as a ship's rate for seagoing vessels entering and leaving the port. This ship's rate is 10 kopecks (5 cents) per ton burthen. A reduction is allowed to ships sailing under the Russian flag between Russian ports situated on different seas (as for instance Riga-Odessa, Riga-Vladivostok, etc.), as well as to such vessels as ply regularly between Russian and foreign ports; the reduction consists of charging only once during the entire navigation season. Entirely exempt from the tax per ton burden are all ships plying under the Russian flag between Russian ports lying on the same sea (as for example Riga-Libau, Riga-Windau, Riga-Pernau—all ports on the Baltic).

The pood rate levied, as stated, on all goods passing through the port, varies according to the kind of merchandise and is governed by a fixed schedule compiled by the Government. There is, however, a distinction between goods transported coastwise from Riga and such as are imported or exported by sea. Goods transported coastwise pay a smaller rate, the maximum being one-third kopeck (one-sixth cent) per pood of 36 pounds, and the minimum one-twelfth kopeck (one-twenty-fourth cent) per pood. The maximum rate on goods imported or exported by sea is 1 kopeck (one-half cent) and the minimum one-fourth kopeck (one-eighth cent) per pood.

As an example, cement, bricks, and chalk transported coastwise from Riga to other Russian ports pay one-twelfth kopeck per pood, but if exported the rate is one-fourth kopeck per pood. Coal, coastwise, pays one-twelfth kopeck per pood, while this commodity imported by sea pays one-fourth kopeck. A schedule of the pood rates follows.

#### SCHEDULE OF POOD RATES ON MERCHANDISE PASSING THROUGH THE PORT OF RIGA.

A pood rate of one-fourth kopeck (one-eighth cent) is levied on the following goods:

Grain.
Fertilizers.
Lime.
Alabaster.
Coke.
Metals.
Salt.
Pit props.
Peas.
Coal briquets.
Sulphur pyrites.
Potatoes.
Powdered glass.
Rye.
Barley.
Spelt.
Oatmeal.
Emery stones.
Flint stones.
Asphalt blocks.
Infusorial earth.
Hay.
Clay (excepting for dyes).
Gypsum.
Coal.
Raw naphtha.
Iron slag.
Firewood.
Boards, ends of.
Beans.
Bone meal.
Lentils.
Malt.
Charcoal.
Wheat.
Buckwheat.
Vetches.
Flax waste.
Millstones.
Quartz.
Fluorspar.
Metal refuse (slag).
Straw.
Chalk.
Cement.
Nonprecious stones (excepting marble).
Naphtha refuse.
Common bricks.
Posts, poles.
Bran.
Peat.
Nitrate of soda.
Maize.
Common sand.
Chlorite of potash.
Oats.
Millet.
Sorghum.
Bran (all kinds of siftings).
Stassfurth potash salts.

Feldspar and other stones, not otherwise provided for, serving as raw material for manufacturing industries, in pieces.
Espen blocks (square) of about 5 feet length and one-half inch diameter.
Cast iron, iron, steel, unmanufactured, rails, and rail fastenings.

A pood rate of one-half kopeck (one-fourth cent) is levied on the following goods:

All seeds.
Hemp.
Woodware (excluding cabinet wood).
Pitch, tar.
Heavy spar.
Oak blocks.
Flax.
Flour.
Castor oil.
Sesame flour.
Oak sleepers.
Beach beams, fir, birch, maple, ash.
Tow.
Groats.
Rosin, gum.
Match wood.
Oak staves (ungrooved).

On all other articles a pood tax of 1 kopeck (one-half cent) per pood is levied. (One pood equals 36 pounds.)

Exempt from the pood tax are:
Coal and coke imported for the ministries of marine and war.
All articles allowed duty free to foreign ambassadors and consuls.
Goods not delivered at the port of destination in consequence of shipwreck or storm.
Salt imported from the Azov and Black Seas.
Goods moved within the limits of the port.
Common stones.
Military stores.
Goods brought on inland waterways.
Imported goods reexported without unloading or transfer.
Passenger's baggage.
Ship's stores.
Goods less than 144 pounds in weight per lot.
Rubble for building, sand, and other material serving as ballast.
Broken tiles and all goods exempted by sections 1, 2, and 3 of paragraph 120 of the regulations of May 15, 1901, now embodied in paragraph 474 of the customs regulations.
Limestone.
Ice.

NOTE.—Cast iron, iron, steel (unmanufactured), rails, and rail fastenings are subject to the one-quarter kopeck pood tax only if exported. This provision remains in force until January 1, 1911. These goods, when imported, pay 1 kopeck (one-half cent) per pood. On goods shipped from one Russian port to another, the pood tax is only one-third of the above-mentioned rates.

The customhouse officials collect the ship's and pood rates in accordance with special instructions.

*Canals.*—The only canal of commercial value in this district is the Dvina-Aa Canal, connecting the river Dvina and the Livonian Aa. It is owned by a private company, the Livländische Gesellschaft zur Verbesserung der Flussverbindungen (the Livonian Co. for the Improvement of Waterways). The canal serves chiefly for the rafting of timber, while other goods seldom are transported by this means. For the use of the canal the company charges from 1½ kopecks (three-fourths cent) to 10 kopecks (5 cents) per piece of timber. For example: Logs, 10 kopecks; sleepers, 10 by 15 inches thick, 4½ kopecks (2¼ cents); sleepers, 20 by 20 inches thick, 7 kopecks (3½ cents) per piece. All the timber passing through the canal must be plainly marked. The raftsmen must be supplied with an exact list, giving the dimensions of the pieces of timber rafted. The rafts must be transferred personally by an employee of the timber merchant to the canal company at the entrance to the canal. One-half of the canal tolls must be paid upon entering and the other half upon leaving the canal.

The company is not a transportation concern, as it might appear from the inclosed tariff of charges. Private contractors, under

agreement with the company, undertake the guiding of the rafts through the canal and the connecting streams and small lakes at the rates indicated on the list and are responsible to the company for the canal tolls, which represent about one-half of the rates on list. The prices on inclosed schedule cover transportation from the entrance to the canal on the Livonian Aa to Mühlgraben, on the right bank of the Dvina. If it is desired to have the rafts towed upstream to Riga, there is an additional charge of 3 kopecks (1½ cents) per log, and 1 kopeck (one-half cent) per sleeper.

*Rafting down the River Dvina.*—Considerable quantities of timber are floated down the river Dvina to Riga. During 1908, the number of rafts carried to Riga was 17,100. The cost of rafting varies from 8 to 25 kopecks (4 to 12½ cents) per fathom according to distance and difficulty of guiding the rafts, such as low water, rapids, storms, and similar unforseen obstacles. Adding the cost of 4 kopecks per fathom for rope, nails, and binding, the total cost of rafting from the upper Dvina and its tributaries to the precincts of the port of Riga is from 12 to 29 kopecks (6 to 14.5 cents) per fathom. Here the rafts are taken over by a special raftsmen union, a responsible association, which has obtained the exclusive right of conducting the rafts into the harbor from the Gladki Rapids (a point 12.2 miles above the first bridge), upon condition that sufficient hands are supplied for receiving and berthing at least 400 rafts daily. The association has fixed charges, the rate being 3.5 kopecks (1.7 cents) per log, or three sleepers. Rafting from timber harbor to final destination, such as export quay, sawmill, winter harbor, etc., costs 2 kopecks (1 cent) per log. The city charges a tax of 1½ kopecks (seven-tenths cent) per piece. The Government charges a tax of 20 kopecks (10 cents) per raft not exceeding 250 logs, which is levied by requiring each raft or fleet of rafts to be provided with a ticket bearing the requisite number of Government revenue stamps.

During the winter most of the timber is hauled on shore. Tracts of shore land can be rented for 3 to 5 kopecks (1½ to 2½ cents) per log.

*Navigation companies.*—Aside from a number of small concerns and individuals owning a few tugs, barges, and river boats there is only one navigation company of importance carrying freight from Riga to certain points along the river Courland Aa, the farthest point being the town of Mitau, in the Government of Courland, a distance of 69.30 miles. The company owns 35 barges of which 7 are of iron, and 20 steamers and tugs. The steamers chiefly transport passengers (from 40 to 350 according to size) and a limited amount of piece goods. No tolls are levied by the Government. The only tax in the nature of a toll coming to the Government is a revenue stamp of 15 kopecks (7½ cents) which it requires to be affixed to each bill of lading, and 2 kopecks (1 cent) for the form. The rates apply to transportation from Riga to Mitau and vice versa, including unloading, the latter service representing about one-fourth kopeck (one-eighth cent) per pood. These rates were more or less stable during the shipping season. For large quantities, however, a reduction of 10 to 25 per cent is made for coal, for which the company holds annual contracts, as much as 50 per cent reduction is allowed, the schedule rate for this commodity being 3 kopecks per pood, while the contract rate is 1½ kopecks. As a development of a

small existing line of steamers on the upper reaches of the Dvina, from Welisch to Witepsk, a distance of about 50 miles, a company with a capital of $150,000 has just been formed to commence enlarged operations next summer. The company has purchased 8 stern-wheel steamers, originally intended for the River Volga. These steamers are copies of the American type and were built by the shipbuilding concern Lange & Sohn in Riga. The company proposes to carry freight as well as passengers. More details about this new enterprise are not obtainable.

Prorating arrangements do not exist between water lines and railroads in the territory covered by this report. The railroads carry almost all the freight, and their rates are not influenced by the cheaper rates of the water-borne traffic. The competition of waterways is too small to affect railroad freight rates. This condition is clearly illustrated by the tables on page 66, which gives comparative figures for five principal articles of water-borne and rail traffic to Riga during 1907 (the last statistics available). Taking two examples from this table, 94,278 tons of flax came by rail, while only 928 tons arrived by water; 39,373 tons of rye came by rail, and only 876 tons by water.

If systematically exploited there is no doubt that the waterways would have greater competitive power than the railroads, at least during the shipping season, but the severe winter which closes navigation entirely for at least six months will always be a serious impediment to the development of water-borne traffic. The following examples illustrate inland water rates compared with paralleling railway rates for short and for long distances, from which it will appear that the water rates are lower in each instance than the railroad rate. The examples cover points which are connected with Riga by water and by rail.

*Comparative rail and water rates for a distance of 45 miles on the River Dvina.*

RIGA TO FRIEDRICHSTADT.

[Distance by water and rail about equal, 45 miles.]

| Articles. | | Rate. | |
|---|---|---|---|
| | | Rail. | Water.[1] |
| Flax | per ton | $1.76 | $0.96–1.60 |
| Linseed | do | 1.60 | .96–1.60 |

[1] It is difficult to calculate the rate of freight, as a lump sum is charged for the boat whether fully loaded or not.

*Comparative rail and water rates for a long distance on the River Dvina.*

FROM THE TOWN OF BIELOJE TO RIGA (RAILROAD STATION NELIDOVO).

[Distance: Rail, 360 miles; water, 550 miles.]

| Article. | | Rate. | |
|---|---|---|---|
| | | Rail. | Water. |
| Linseed | per ton | $7.05 | $3.84 |

NOTE.—Transportation by water is only possible during high water in spring on flat-bottom boats.

*Comparative rail and water rates on the River Courland Aa, using from Rija a part of the River Dvina.*

FROM THE CITY OF RIGA TO MITAU.

[Distance: Rail, 26.4 miles; water, 69.3 miles.]

| Articles. | | Rate. | |
|---|---|---|---|
| | | Rail. | Water. |
| Coal | per ton.. | $0.64 | $0 32 |
| Flax | do.... | 1.46 | 1.28 |
| Linseed | do.... | 1.00 | .96 |

The railroad lines selected for the first two examples are almost parallel with the waterway, but considerably shorter for the third.

*Coast traffic.*—While the department's circular does not refer to coast traffic, the following table illustrating the coast rates compared with railway rates to corresponding points on the Baltic coast may be of interest in particular, as the coast traffic includes a distance of 8.2 miles on the River Dvina to its mouth. The table gives three examples: Riga to Libau, Riga to Windau, and Riga to Pernau.

*Comparative table of rail and coast traffic rates between Riga and the three Baltic ports, Libau, Pernau, and Windau.*

FROM RIGA TO LIBAU.

[Distance: Rail, 144 miles; river and coastwise, 168 nautical miles.]

| Articles. | | Rate. | |
|---|---|---|---|
| | | Rail. | Water. |
| Flax | per ton.. | $2.45 | $2.2 |
| Beer | do.... | 3.59 | 1.73 |
| Linseed | do.... | 3.52 | 1.92 |
| Iron | do.... | 3.20 | 1.60 |

FROM RIGA TO PERNAU.

[Distance: Rail, 182 miles; river and coastwise, 78 nautical miles.]

| | | | |
|---|---|---|---|
| Flax | per ton.. | $5.49 | $2.56 |
| Beer | do.... | 4.50 | 1.60 |
| Linseed | do.... | 2.88 | 1.92 |
| Iron | do.... | 6.09 | 1.60 |

FROM RIGA TO WINDAU.

[Distance: Rail, 116 miles; river and coastwise, 108 nautical miles.]

| | | | |
|---|---|---|---|
| Flax | per ton.. | $2.35 | $2.25 |
| Beer | do.... | 2.87 | 1.73 |
| Linseed | do.... | 2.88 | 1.92 |
| Iron | do.... | 2.88 | 1.60 |

*Towing charges.*—There being no upstream traffic on the Dvina, no towing of boats or barges is required in this direction. On the Courland Aa the bulk of the traffic is handled by the Steam Navigation Co. of A. Augsburg with its own boats and steam tugs, the charge being included in the freight rate. Towing service is practically restricted to the port of Riga and the section of the river

to its mouth. While the exchange committee owns a number of tugs which are principally used for moving the dredges, ice breakers, the floating dock, etc., there are a number of steam tugs owned by individuals available in the port. The charges vary from 3 to 10 rubles ($1.54 to $5.15) per hour according to size of tug. Example: Turning around of a vessel costs 5 rubles ($2.57).

*Insurance.*—In most cases goods transported by inland waterways are insured, the risk being taken by the carrier. The insurance averages 1 per 1,000, and, considering the short distances upon which valuable goods are transported, the freight rate is not affected. The above refers to merchandise transported by large navigation companies, such as A. Augsburg in this city. In cases of goods being transported by small contractors, the shipper assumes the risk, or insures with insurance companies.

*Cooperation of rail and water lines.*—All the railroads in this section of Russia are Government property. The table on page 66 plainly shows that the water-borne traffic is insignificant compared with the railroad. Active competition does not exist, the railroad is not influenced by the lower water rates, and no attempt has been made to regulate the relations between inland water and railroad systems of transportation, nor to make agreements for the division of traffic.

### OWNERSHIP OF VESSELS AND BUSINESS ORGANIZATIONS.

The questions contained under this heading in the department's circular are not applicable to the conditions in this district. The only canal and waterway improvement company—the Livonian Co. for the Improvement of Waterways—which owns the Dvina-Aa Canal, and has secured the exclusive right to improve all the existing waterways in the Government of Livonia does not own nor operate vessels.

There are no fleets of merchant vessels owned and operated by public authorities, nor do the railroads own vessels for the transportation of merchandise. There are no monopolies or combinations controlling towing on rivers and canals. (See paragraph under "Towing.")

### FLOATING EQUIPMENT.

The vessels used on the river Dvina consist of flat-bottomed boats constructed of wood and equipped with oars and sails. They are locally known as "laibys," have an average length of 80 feet, width 16 feet, and a draft, when loaded, of 2 to 2½ feet. They are built and owned by peasant farmers living upstream along the river banks, can carry from 343 to 1,372 cubic feet of building stone, and cost from $75 to $175. In addition to the laibys, timber is carried on barges owned by the local sawmills.

A special type of boat which is only used for carrying linseed and oats from the Government of Smolensk during high water in spring, is a flat-bottomed vessel, locally called "struse," the starting point being, as a rule, the town of Bieloje on the Dvina, about 660 miles from Riga. These boats are built entirely of hewn timber, the fastenings being by means of wooden nails. They possess no equipment and are dependent upon the current which carries them downstream. In former years, as has been already mentioned in this report, the number of "strusen" floated down to Riga was considerable, but since

the construction of railroads this traffic has been diverted from the river, owing to the danger of navigation and the length of time occupied in transit (from six days to three weeks). The chief reason, however, for this decline in traffic is that this method of transportation is only available in spring; goods, therefore, bought in the autumn, if it is desired to use the waterway, must be held during the whole winter before shipment, which naturally considerably adds to their cost and which such commodities as linseed and grain are not well able to bear. The "strusen" can carry from 160 to 195 tons. When fully laden, their draft is about 42 inches and their cost averages $200. The most striking feature of this method of transportation is that after their cargoes are discharged the "strusen" are broken up and sold for building material and fire wood, fetching from $50 to $60 per vessel.

On the Courland Aa the freight is carried on the native laibys, and by the fleet of the Augsburg Navigation Co. owning, as stated, 35 barges and boats, of which 7 are of iron. These boats can carry from 50 to 150 tons; the 50-ton boat, which is the smallest size, is 70 feet long, 15 feet wide, and costs, if made of iron, $4,000; if built of wood, $500. The largest size, having a length of 100 feet and a width of 22 feet, can be purchased, if of iron, for $7,000, and of wood for $750. The company also owns 19 passenger and freight steamers and 1 iron barge propelled by a 20-horsepower suction gas engine. The passenger steamers run daily to the mouth of the Dvina, and up the River Courland Aa to the manufacturing towns of Schlock and Mitau, and carry from 40 to 350 passengers and a limited quantity of piece goods. The size of the smaller steamers is 40 by 10 feet, and cost about $6,000; that of the larger, 130 by 21 feet, costing $20,000. Steam tugs cost from $6,500 to $8,000. Their draft averages 5 to 5½ feet.

The total number of river steamers and steam tugs registered at the port of Riga is 124 screw steamers with a total of 1,544 registered tons, and 2,229 horsepower, and 11 paddle-wheel steamers of 354 registered tons and 418 horsepower.

### WATER-BORNE TRAFFIC.

Traffic on the River Dvina bears in general a local character and consists principally of building material, lime, clay, river sand, bricks, cement, and the like, brought down to the city of Riga, and to a small extent of food products. The amount of this traffic in 1907 within a 75-mile limit (at a point called Kokenhusen, where the principal lime and sandstone quarries are located) comprises 30,958 tons, carried on 1,971 boats, out of a total river-borne traffic of 36,859 tons.

Beyond this 75-mile limit the commodities brought down the river were goods destined for export in quantities as follows:

| | | |
|---|---|---|
| Flax | tons | 40 |
| Oats | do | 840 |
| Barley | do | 32 |
| Linseed | do | 2,605 |
| Rosin | do | 164 |
| Tar | do | 32 |
| Total (carried in 57 boats) | do | 3,713 |
| Oak staves (carried in 4 boats) | pieces | 3,480 |

On the Courland Aa the same characteristics prevail to an even greater extent, the articles of export in 1907 amounting only to 595 tons of rye and 271 tons of linseed.

The upstream traffic on the River Dvina is insignificant, only two boats proceeding upstream in 1907 with freight.

The upstream traffic on the Courland Aa, on the other hand, is considerable, numbering, in 1907, 409 boats carrying freight and coal to the factories at Schlock and Mitau.

Classified according to articles, the water-borne traffic on the Rivers Dvina and Courland Aa to and from Riga during the year 1907 is detailed on the following tables:

*Water-borne traffic to Riga on the River Dvina.*

| | Tons. |
|---|---|
| Food products and fodder: | |
| Apples | 9 |
| Barley | 305 |
| Oats | 840 |
| Potatoes | 437 |
| Clover | 16 |
| Rye | 133 |
| Cabbage | 3 |
| Peas | 5 |
| Total | 1,748 |
| Semimanufactured articles, building material, and sundries: | |
| Flax | 577 |
| Lime | 4,558 |
| Linseed | 4,333 |
| Rosin | 180 |
| Clay | 270 |
| Stones— | |
| Gypsum | 4,250 |
| Lime | 17,874 |
| Paving | 2,860 |
| Various | 70 |
| Gravel | 60 |
| Tar | 35 |
| Bottles | 2 |
| Wood shavings | 42 |
| Bricks, 10,000 pieces. | |
| Total | 35,111 |

*Water-borne traffic to Riga on the river Courland Aa.*

| | Boat loads.[1] | Tons. |
|---|---|---|
| Food products and fodder: | | |
| Vegetables | 10 | |
| Hay | | 1,642 |
| Cabbage | 23 | |
| Groceries | 20 | |
| Rye | | 595 |
| Total | 53 | 2,237 |

[1] The statistics, in some instances, only give number of boats without the weight, in others the tons without specifying the number of boats. One boat carries about from 60 to 65 tons.

| | | |
|---|---|---|
| Manufactured articles, building material, sundry goods, etc.: | | |
| Bricks | pieces | 28,485,000 |
| Tiles | do | 126,000 |
| Gypsum | sacks | 11,300 |
| Stones | cubic fathoms[1] | 1,340 |
| Clay | do | 680 |
| Old iron | tons | 100 |
| Flax seed | do | 271 |
| Cement | do | 367 |
| Window and door frames | boat loads | 6 |
| Sundry goods | do | 23 |

*Water-borne traffic from Riga on the Courland Aa.*

| | | |
|---|---|---|
| Groceries | boat loads | 44 |
| Stones | cubic fathoms | 96 |
| Sand | do | 168 |
| Petroleum | tons | 177 |
| Fertilizers | do | 1,383 |
| Coal | do | 5,542 |
| Firewood | cubic fathoms | 7,000 |
| Boards | pieces | 17,000 |
| Pipes | do | 7,000 |

*Wages, conditions of labor.*—The only typical feature of labor in this port is a responsible association of raftsmen, called the "Ankerneeken," whose duties and charges have been described in an earlier part of this report. (See p. 72 under the heading "Rafting down the Dvina.")

The charges specified are controlled by the exchange committee. Labor for unloading and loading in the port is engaged by the day at the rate of $0.75 to $1.50 per day for men, and $0.40 for females. A certain number of laborers are regularly employed within the limits of the customhouse area, their wages averaging about $1 per day. They form a responsible association for handling imported goods, especially for unpacking, weighing, and repacking merchandise when being cleared at the customs.

*Statistics of rail and water-borne traffic.*—The statistics of vessel movement and traffic carried on the Rivers Dvina, the Courland Aa, and the Livonian Aa, as well as statistics of railroad traffic to and from the port of Riga, are collected and published annually by the "Rigaer boersen comite" (Riga exchange committee).

## GENERAL REMARKS.

The greater part of the information contained in this report was collected from personal interviews. The publications consulted were the annual reports of the exchange committee at Riga, "The port of Riga," by Chief Port Engineer A. Pabst, and a number of official publications issued by the ministry of ways and communications. The local authorities, and in particular the Riga exchange committee, to whom I had submitted translations of the technical questions contained in the department's circular, declined to render assistance, stating that they were not in a position to undertake such a complicated and voluminous work.

[1] One cubic fathom equals 7 cubic feet.

# APPENDIX.

TARIFF OF THE BRIDGE PASSAGE AND RIVER TAXES ON THE BRIDGE ACROSS THE RIVER NAREW AT THE VILLAGE WIERZBICA ON BASIS OF THE DECISION OF THE COUNCIL BOARD OF OCTOBER 26/NOVEMBER 7, 1834, No. 16693.

*Bridge-passage tax.*

| | Kopecks. |
|---|---|
| (*a*) A pedestrian | 1 |
| (*b*) Horned cattle or horses per head | 2 |
| (*c*) Sheep or swine per head | 1 |
| (*d*) Van or cart, unloaded, without harness and equipment | 2½ |
| (*e*) Ordinary van or cart, loaded, without horse and equipment | 5 |
| (*f*) Carriage or coach without horse and attendants | 10 |
| (*g*) Van, loaded, without horse and attendants | 15 |

NOTE.—According to the decrees of the department of highway roads and waterways dated May 23, 1887, No. 3131, and December 1, 1888, No. 8673, it will be noted as follows:

(1) That vans and carts, which are subject to the payment of the lesser tax as per (*d*) and (*e*), are all those kind of vehicles which have no carriage springs.

(2) That loaded vans and carts, which are subject to the higher tax of 15 kopecks, are those vehicles which are specially constructed for carrying goods.

(3) That the tax for unloaded passenger vehicles is the same as for ordinary vans without springs and cargo.

(4) That the tax for vehicles, with cargo or without, for carriages, with horse and equipment thereto, is collected separately.

(5) That vans loaded with sheep, swine, or calves pay the same tax as do unloaded vans, but in addition to this the cattle are taxed separately.

(6) That vehicles with more than 300 poods cargo are forbidden without special permission of the local engineering authorities.

*River tax.*

| | Kopecks. |
|---|---|
| (*a*) For boats less than 40 feet long | 15 |
| (*b*) For boats exceeding 40 feet | 30 |
| (*c*) For boats with a roof of from 80 to 90 feet | 45 |
| (*d*) For boats called "jadwiga" | 37½ |
| (*e*) Steamers with mast or sail | 37½ |
| (*f*) Boats called "szkuta" | 75 |
| (*g*) Floats of timber (rafts), per piece | ½ |
| (*h*) Half floats of timber (rafts), per piece | ½ |

If the bridge has to be taken apart, the above taxes will be doubled.

On the basis of the regulation of the committee of ministers of September 12, 1880, approved by supreme order, instead of the tariff issued on October 26, 1834, fixing the tax at one-half kopeck for each piece of timber, floated down the river Narew through the bridge of Wierzbica, the tax has been reduced to one-third kopeck per piece.

NOTE.—(1) Light wooden shelters and timber indispensible for the use of the staff while floating down are not considered as goods and are exempt from the tax. (2) Floating accessories are not considered as goods and are not subject to the tax. (3) According to the statement of the department of highway roads and waterways communications of March 17, 1880, No. 1692, all timber wood is subject to taxes, with the exception stated above, and referring to local orders or decrees will not be admitted.

EXEMPTIONS FROM PAYMENT OF BRIDGE TAX.

1. Horses conveying the Sovereign and his suite.
2. Vehicles of peasants with any kind of harness, loaded or unloaded.
3. Cattle and horses going to pasture and also plows and vans loaded with fertilizers.
4. Carts loaded with corn in sheaf or hay carted from the meadow.
5. All fiscal, military, and postal transports (with the exception of extra posts), and also transports of undertakers, if contracted by the Government, if a special clause is made in the contracts in this respect (these transports are also exempt from the river tax).
6. Carts carrying building material for towns, villages, and settlements, if certificates from the mayor or chief of the community have been secured.
7. Carts carrying material for highway roads and ordinary roads, and also transports of tobacco, Government salt, there and back, if these materials or goods are sent on behalf of the authorities or by contractors, if they are entitled to be exempt from the bridge tax.
8. Extra post horses on their return journey.
9. Horses carrying military transports.
10. All household transports within their own district.
11. Horses of the officials inspecting the highway roads in their official capacity.
12. Horses of monks and Sisters of Mercy performing their duties.
13. The prioress of the "Infant Jesus" Hospital at Warsaw, and the Sisters of Mercy, traveling on official business.
14. Vehicles of the property of hospitals and charity institutions.
15. Priests of all creeds, if in their own parishes, in the performance of their duties, and also their vehicles and horses.
16. Those attending the aforementioned vehicles are also exempted.
17. All soldiers singly or otherwise, if they cross the bridge on foot or ride across, while in uniform, as well as their attendants, vehicles and horses.
18. Officials and "wojts" of communities in their official capacity, if provided with certificates from their chiefs, and also bailiffs and local peasants if traveling in the interests of the police or communal authorities.
19. Forest officials and their guards.

To the above the following remarks are added:

(*a*) Contractors supplying horses to the Government at its order, if they desire to be exempt from the bridge tax, must be provided with a proper certificate issued by the chief of the district, burgomaster, or chief of community.

(*b*) Government transports are not only those which are being forwarded by order of the administrative, civil, or military authorities, but also those which are sent by contractors, on the basis of contracts made with the Government, and stipulation for the exemption is made in the contracts.

(*c*) Peasant products are such as milk, milk products, cheese, butter, poultry, eggs, flour, groats, etc., whereas other goods such as timber and other products of commerce are subject to the payment of the bridge tax.

(*d*) Peasants, inhabitants of towns, villages, and settlements, in which the bridge tax is established, when crossing the bridge with transports of household effects, are not subject to the payment of the tax. This equally applies to servants employed on estates and to peasants on estates and settlements.

(*e*) Retired soldiers bearing no sign of active service, although even wearing retired soldiers' uniform, must pay the tax on the basis of an order of the late governmental committee of the home department and of the police dated October 14/26, 1826, under No. 62(217).

(Signed by the chief of highway roads and communications for the district of Warsaw; the inspectors, members of the district committee; and the chief of the chancery.)

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TARIFF OF THE BRIDGE PASSAGE AND RIVER TAXES ON THE RIVER VISTULA, AT PLOTZK, RUSSIAN POLAND.

*Bridge passage tax during any time, and transport tax from May 1 to November 1.*

| | Kopecks. |
|---|---|
| (*a*) A pedestrian | 1 |
| (*b*) A horse, harnessed or unharnessed, and horned cattle | 3 |
| (*c*) Sheep, goat, or swine, per head | 1 |
| (*d*) Unloaded cart | 3 |
| (*e*) Cart, loaded, and carriages | 6 |
| (*f*) Passenger cab | 15 |

*Transport tax from November 1 to May 1.*

| | |
|---|---|
| (*a*) A pedestrian | 2 |
| (*b*) A horse, harnessed or unharnessed, and horned cattle | 6 |
| (*c*) Sheep, goat, or swine, per head | 2 |
| (*d*) Unloaded cart | 3 |
| (*e*) Cart, loaded, and carriages | 12 |
| (*f*) Passenger cab | 30 |

NOTE.—In case of the presence of large quantities of ice in the river the tariff may be raised by one-half of the above, namely, from 2 to 3 kopecks, from 6 to 9 kopecks, etc.

For crossing in the ice no taxes will be collected.

*Explanation 1.*—According to the present tariff the tax for loaded or unloaded vans will be collected separately from that for horses and attendants.

*Explanation 2.*—The tax for vans loaded with sheep, swine, lambs, or calves will be the same as per unloaded vans, but in addition to this the usual tax for the animals carried, as well as for the accompanying people, will be collected.

*River tax.*

| | Kopecks. |
|---|---|
| (*a*) A small barge, loaded | 75 |
| (*b*) A small barge, unloaded | 37½ |
| (*c*) Rafts of timber for building purposes, etc., when bridge has to be taken apart (note 1) | 150 |
| (*d*) Any kind of boat passing through the open bridge | 150 |
| (*e*) Loaded boats and small vessels passing under the bridge | 37½ |

*Explanation 1.*—Boats or rafts which could pass under the bridge, following larger boats through the bridge, when taken to pieces, pay the same tax as if they passed under the bridge.

*Explanation 2.*—Rowing boats or canoes, unloaded, passing under the bridge pay no tax.

NOTE 1.—A tariff raft is reckoned as follows: (1) Composed of masts from 60 to 80 pieces; (2) composed of squared "Danzig" beams from 108 to 180 pieces; (3) composed of building beams from 168 to 280 pieces; (4) composed of purlins from 180 to 300 pieces; (5) composed of rafters from 288 to 480 pieces; (6) composed of planks from 100 dozen to 170 dozen; (7) composed of beams from 75 dozen to 120 dozen; (8) composed of staves from 230 dozen to 400 dozen; (9) composed of firewood from 131 to 200 pieces. The tax therefore for these quantities should be collected as per tariff, namely, 1.50 rubles per raft and 75 kopecks per half raft. Half rafts are considered such, in which the timber does not exceed the minimum figure for rafts, namely, half rafts of timber for masts are 1 to 59 pieces; half rafts of squared "Danzig" beams are from 1 to 107 pieces, etc. As to rafts exceeding the size of full rafts, the tax will be collected per 1½ rafts, 2 rafts, etc., no matter what the exact number may be; for instance, if a raft of mast timber contains from 81 to 139 pieces, the shipper must pay for 1½ rafts, but if the raft contains 140 to 160 pieces, the tax payable will be for 2 rafts, etc.

NOTE 2.—Double sleepers and crooked parts of trees for the construction of boats are enlisted in the second category.

NOTE 3.—Single sleepers belong to the fourth category.

EXEMPTIONS.

The following are exempted from payment of the above-mentioned taxes:

1. Ordinary postal carts.
2. Government transports.
3. Soldiers, singly or on the march, and also military transports.
4. Carts containing forage, there and back.
5. Pedestrians or carriages, passengers traveling on Government business, and also those traveling in the interest of the Hospital of the Sisters of Mercy at Plotzk, if they are provided with a proper certificate when crossing the Vistula to reach one of the islands belonging to the said hospital.

(Signed by the chief of branch for the bookkeeper.)

## TARIFF OF THE BRIDGE PASSAGE AND RIVER TAXES ON THE BRIDGE ACROSS THE RIVER VISTULA AT VLOTZLAVEK, RUSSIAN POLAND.

*Bridge passage tax from May 1/14 till November 1/14, ratified by decree of the viceroy of the Kingdom of Poland, on December 10/22, 1864.*

| | Kopecks. |
|---|---|
| (*a*) A pedestrian | 1 |
| (*b*) A horse, harnessed or unharnessed, and horned cattle | 3 |
| (*c*) Sheep, swine, goats, calves, per head | 1 |
| (*d*) Unloaded carts | 3 |
| (*e*) Loaded carts | 6 |
| (*f*) Carriage without luggage | 5 |
| (*g*) Carriage with luggage | 10 |
| (*h*) Cabs with luggage | 15 |

*Remarks.*—(1) The tax for carts whether loaded or not, and for carriages, horses, and attendants, will be collected separately. (2) Carts loaded with sheep, swine, or calves pay the same tax as do unloaded carts, but in addition to this a tax for each animal will be collected separately.

*Bridge passage tax from November 1/14 till May 1/14, ratified by the viceroy's decree dated December 10/22, 1864.*

(1) The tax during this part of the year will be double that stated above.
(2) For transport and passage on the ice no tax whatever will be collected.
(3) Goods which are not transported in a cart do not pay according to the tariff, but according to a mutual agreement made with the tollgate keeper.
(4) Hand luggage pays no tax.

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*River floating tax for vessels and rafts, ratified by supreme order and referred to in the declaration of the department for highway roads and water communications, dated August 4, 1872, No. 4550.*

| | Kopecks. |
|---|---|
| (1) Barges less than 70 feet long | 60 |
| (2) Barges more than 70 feet long | 90 |
| (3) Steamers, barges, or so-called "berlins" | 150 |
| (4) A double block of mast timber or crooked parts of trees, without cargo | 40 |
| (4*a*) Same as above, but with cargo | 60 |
| (5) A double square block of any other kind of timber, without cargo | 20 |
| (5*a*) Same as above, but with cargo | 30 |

*Remarks.*—(1) A square of timber is a portion of floating timber, fastened together in one whole, the width of which constitutes the width of the raft. (2) Any kind of timber, under whatever name it should be designated, forming a raft, constitutes the cargo, with the exception of light shelters, clothing, and food for the accompanying attendants and indispensable for floating. (3) According to the explanation of the ministry of communications, published by decree by the late board of highway roads and waterway communications, dated March 31, 1902, No. 4755/1052, the right to collect the above taxes ceases with the nonexistence of the bridge.

Explanation to the first remark of the floating tariff, ratified by the ministry of highway roads and communications on August 8, 1873, No. 4370:

(*a*) A single block (two of which compose a double block) is reckoned timber not wider than 12 to 15 feet, and therefore a

double block does not exceed 30 feet. All others are considered double or triple rafts or blocks, etc.

(*b*) Blocks composed of timber 42 feet long, and even longer, are reckoned as mast timber and refer to clause 4 of tariff No. 3. All other kinds of timber, with the exception of crooked parts of trees, joined together into shorter blocks than 42 feet, are considered ordinary building timber and refer to clause 5, tariff No. 3.

(*c*) Crooked parts of trees are angular ribs, prepared in a bow-shaped manner, used for shipbuilding, and must not exceed in length 42 feet.

The following exemptions from the bridge passage tax and river tax are made:

1. Horses used for the convenience of sovereigns and their suites.
2. All Government, military, and postal transports, with the exception of extra posts, and also transports of contractors contracted by the Government, if according to these contracts they have been relieved from said tax.
3. All postal and cabinet messengers and ordinary post conveyances, as well as post horses on their return.
4. Extra post horses on their return.
5. Horses for the conveyance of military transports.
6. Officials, be they army or civil, if traveling for the purpose of their service, as well as their horses and vehicles.
7. Horses of monks and sisters of charity, if traveling on business.
8. Vehicles belonging to hospitals and charitable institutions.
9. Priests of all creeds in their own parishes, if traveling in the performance of their duties, and also vehicles with the dead belonging to the parish.
10. Persons in attendance thereon are also exempted.
11. Soldiers, singly or on the march, and also their servants, carriages, and horses; a tax, however, for hired horses and vehicles and for the staff accompanying same, if they are not soldiers, will be imposed.
12. Chiefs of communities, if traveling for recruiting purposes, and are supplied with certificates from their superior authorities.
13. Cattle and horses going to pasture and also plows and carts with fertilizers for improving the soil of the inhabitants of the neighborhood of Vlotzlavek.

The following are exempted from the river tax:

1. Small boats or vessels without cargo, not specified in the above tariff.
2. Boats with material for the remount or building of highway roads, floated by Government contractors, if such exemption is mentioned in the contract.

EXPLANATION OF THE ABOVE CLAUSES.

(*a*) The party procuring horses at the request of the Government in order to be relieved from the bridge passage tax, when proceeding both ways, must produce a proper certificate issued by the chief of the district, burgomaster, or chief of the community.

(*b*) Not only those transports transported by order of the administrative, civil, or military authorities, but also those goods which are being forwarded by contractors according to contracts made with

the Government, are considered as Government transports, in which case the contractors must produce certificates showing relief from such tax.

(*c*) Retired soldiers, bearing no sign of active service, even when in unform, are, by order of the late committee of the affairs of the interior and police, dated October 14/26, 1826, No. 622/17, subject to pay the bridge pasage tax.

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CONTRACT OF LEASE FOR COLLECTING THE BRIDGE PASSAGE TAX AND THE FLOATING TAXES ON THE IRON BRIDGE OVER THE RIVER NAREW, AT THE VILLAGE OF ZEGRZE, DISTRICT OF WARSAW, GOVERNMENT OF WARSAW, ON THE 27TH VERST OF THE KOVNO HIGHWAY ROAD, IN THE THIRD PRAGA-NOVOGEORGEVSK SECTION OF THE WARSAW DISTRICT OF ROADS AND COMMUNICATIONS.

In the year 1905 we, the undersigned, acting as representatives of the Warsaw Exchange Workmen's Association, have made a contract with the management of the Warsaw circuit of roads and communications to the effect that the said management has granted a lease and the Workmen's Association has taken on lease the bridge passage and river taxes on the permanent iron bridge over the River Narew in the village of Zegrze, on the following conditions:

PARAGRAPH 1. The collection of the bridge passage tax from drivers and passengers shall take place at the bridge, and the collection of the river floating tax shall be made at the village of Serotzk. The term of the lease has been fixed from January 1, 1905, till January 1, 1908.

For the privilege of collecting both taxes, the leaseholder binds himself to pay into the treasury the sum of 15,010 rubles in monthly installments, payable in advance. The amount stated is to be paid within the first three days of each month into the treasury of the government of Warsaw, at Warsaw.

The amount payable annually according to the lease shall be divided and payable as follows: In January and February 2 per cent of the amount is payable, namely, 300 rubles; in March 3 per cent, namely, 450 rubles; in April 6 per cent, namely, 900 rubles; in May, June, July, August, and September in the proportion of 15 per cent, namely, 2,252 rubles; in October 8 per cent, namely, 1,200 rubles; and finally, in November and December, 2 per cent, namely, 300 rubles.

For delay in payments the leaseholder incurs a penalty according to article 71 concerning treasury quit rents.

PAR. 2. The leaseholder is entitled to the collection of the said taxes, as per regulation of a former viceroy of the Kingdom of Poland, dated December 15, 1818, concerning the bridge at Zegrze.

*Bridge passage tax.*

| | Kopecks. |
|---|---|
| (*a*) A pedestrian | 1 |
| (*b*) Horned cattle or horses, per head | 2 |
| (*c*) Sheep or swine, per head | 1 |
| (*d*) Carts, unloaded, but with men | 2½ |
| (*e*) Carts, loaded, not including horses and men | 5 |
| (*f*) Carriage or coach, loaded, not including horses and men | 10 |
| (*g*) Cab, loaded, without horses and men | 15 |

*Remarks.*—According to the announcements of the former department of highway roads and waterways, dated May 23, 1887, No. 3131, and April 6, 1889, No. 2438, the following is to be noted:

(1) Carts and vans which are subject to a lesser tax than per clauses *d* and *e* of the tariff, are all kinds of vehicles which have no carriage springs.

(2) Loaded passenger carts and vans, which are subject to a higher tax than 15 kopecks, are vehicles specially provided for the carrying of goods.

(3) A passenger cart, unloaded, pays the same tax as an ordinary cart without springs and unloaded.

(4) The tax for vehicles, loaded or unloaded, for carriages as well as for the horses and men in attendance is collected separately from each class, with the exception of unloaded passenger carts (clause *d* of the tariff), and the attendants of same are also free.

(5) Vehicles loaded with sheep, rams, swine, and calves pay the same tax as do unloaded vehicles, but in addition to this a tax per each animal, according to the tariff, shall be collected.

(6) A load of more than 300 poods on any one vehicle shall not be allowed to cross the bridge without receiving first a special permit from the local engineering authorities.

*River floating tax.*

| | Kopecks. |
|---|---|
| (*a*) For boats of less than 40 feet length | 15 |
| (*b*) For boats exceeding 40 feet | 30 |
| (*c*) For boats with roof of 80 to 90 feet | 45 |
| (*d*) For boats called "Jadwiga" | 37½ |
| (*e*) For steamers with mast or sail | 37½ |
| (*f*) Boats called "Szkuta" | 75 |
| (*g*) Rafts of timber, per piece | ⅓ |
| (*h*) Half rafts of timber, per piece | ½ |

According to the regulation of the committee of ministers of September 12, 1880, approved by imperial order, in place of the tariff issued on October 26, 1834, fixing the tax at one-third kopeck for each piece of timber, the tax has been reduced to one-third kopeck per piece.

*Remarks.*—(1) Light wooden sheds and timber, indispensable for the use of the raftsmen, are not considered as goods and are exempted from the tax. (2) The necessary tools on rafts are not subject to the river tax, nor are they considered as cargo, and the following quantity per man is allowed: (*a*) A rudder beam of about 21 feet long; (*b*) boat hooks and two raft tools called "szreki," which can be up to 7 inches in width and 14 to 21 feet in length, and also the transversal ties of the rafts fastened with nails or wooden plugs and consisting of boards of an average thickness of 3 inches, but other transversal ties, consisting of a different kind of timber, and having a commercial value, are subject to the tax according to the tariff, namely, one-half kopeck per piece.

EXEMPTIONS FROM THE BRIDGE PASSAGE.

1. Horses conveying sovereigns and their suites.
2. Carts of peasants of any kind, unloaded.
3. Cattle and horses going to pasture and also plows and carts loaded with fertilizers.

4. Carts carrying corn in sheaf or hay from the meadows.

5. All Government, military, and postal transports (with the exception of extra posts), and also transports of contractors, contracted by the Government, if a special clause in their contracts has been made in that respect. Such transports are also exempted from the river tax.

6. Carts carrying building material for towns, villages, or settlements, if certificates from the burgomaster or the chief of the community have been secured.

7. Carts carrying material for the repair of the highway roads and ordinary roads, and also transports of tobacco, Government salt, in both directions, if these materials or goods are sent on behalf of the authorities or by contractors, if they are exempted from the tax.

8. Extra post horses on their return journey.

9. Horses carrying military transports.

10. All household removals in their own district.

11. Horses of officials when inspecting the high roads.

12. Horses of monks and sisters of mercy traveling on their duties.

13. Vehicles being the property of hospitals and charitable institutions.

14. The lady superior of the Infant Jesus Hospital at Warsaw, and the sisters of mercy when traveling on business.

15. Priests of all creeds in their own parishes when traveling in the performance of their duties, likewise their servants, vehicles, and horses.

16. Those in attendance on these vehicles are also exempted.

17. All soldiers singly or on the march when crossing the bridge in uniform, and also their attendants, vehicles, and horses.

18. According to instructions dated July 24, 1822, No. 554, and also in accordance with clause 5 of agreement made between the Government and Count Krasinski, regarding the handing over of the privilege of crossing over the River Narew at the village of Zegrze, in favor of the treasury, the owner and the peasants of the estate, and also their cattle, are exempted from all taxes when crossing by the bridge, and should it be demolished they can use the river passage, and the leaseholder may under no circumstances collect any tax from them—that is, from the inhabitants of Zegrze.

19. According to regulation dated October 23, 1823, No. 4923/804, the peasants of the village of Rina, situated on the bank of the River Narew, on their way to the parish church in the village of Zegrze, are exempted from the bridge-passage tax.

20. Officials and chiefs of communities in their official capacity, when provided with certificates of their principals, and also baliffs and local peasants, if traveling in the interests of the police or communal authorities, according to regulation of the former committee of the ministry of the interior dated December 6, 1826, No. 559/1174.

In explanation of the foregoing clauses the following is added:

(*a*) Horse owners supplying horses to the order of the Government, if they desire to be exempt from the bridge-passage tax, both ways, they must be provided with a proper certificate, issued by the chief of the district, burgomaster, or chief of the community.

(*b*) Government transports are not only those which are being forwarded by order of the administrative, civil, or military author-

ities, but also those sent by contractors, according to contracts with the Government, if by those contracts they are exempted from such tax.

(*c*) Peasant products are such as milk, cheese, butter, poultry, eggs, flour, groats, etc., whereas others, such as wood and other objects of commerce, are subject to the bridge tax.

(*d*) Retired soldiers bearing no sign of active service, though they might be wearing uniforms of retired soldiers, must pay the tax, according to an order of the former Government committee of the home department and of the police dated October 14/26, 1826, No. 62/217.

*Remarks.*—(1) According to the announcement of the former department of roads of communications and waterways, dated March 17, 1880, No. 1692, any kind of timber for building purposes, with the exceptions above stated, are subject to the tax, and reference to former arrangements with the local authorities is excluded. (2) According to the announcement of the former department of highway roads and waterways, dated January 26, 1881, No. 4061, and in virtue of an agreement made in 1882, and approved by imperial order, with Count Krasinski, as to the handing over of the bridge at Zegrze, to the treasury, in regard to the free passage over the bridge, once and forever, of the inhabitants of the estate of Zegrze, and also as to the transport of all objects belonging to them, across the river Narew, the leaseholder is not entitled to collect any tax whatever from said inhabitants.

PAR. 3. In order to collect the taxes, the leaseholder must keep ticket books, as prescribed by the management of the district, and to issue a receipt to each payee. These books are to be kept in good order, without corrections or erasements, and must be produced on the demand of the local engineering authorities, and to representatives sent by the department of roads and communications.

PAR. 4. The leaseholder renounces any claim against the Government for any possible arrears arising from the amount of taxes received.

PAR. 5. The collecting of the river tax is to be made in the village of Serotzk, and in the order of the arrival of vessels or rafts at such a spot as chosen as the anchoring place by the local engineering authorities.

The collecting of taxes and the issue of receipts are to be made without interruption, constraint, or delay.

Even during the greatest accumulation of boats and rafts receipts are to be issued not later than six hours from the arrival of the declarer at the bridge office.

PAR. 6. A room with a kitchen in the Government building in the village of Zegrze, and two watch houses at each end of the bridge, are to be reserved for the leaseholder.

Expenses in connection with the upkeep of said quarters and watch houses in good permanent order, and in connection with the building, if necessity requires it, of two new watch houses to replace those demolished, as well as repairs and painting, or the building of new barriers in place of those demolished shall be paid by the leaseholder. At the expiration of the contract the leaseholder must give up in good condition the living apartments, watch houses, barriers, and all other accessories, according to the inventory.

The building of the watch houses and barriers is to be done according to designs approved by the management of the district.

PAR. 7. The leaseholder is to put up and keep alight lanterns at the watch houses at his own expense.

PAR. 8. Special quarters to serve as an office for the river tax and another apartment composed of two rooms and a kitchen for the convenience of the inspector of the bridge at Zegrze during the navigation period are to be engaged by the leaseholder.

All repairs of said quarters shall be at the leaseholder's expense.

PAR. 9. The leaseholder is bound to conform himself to the regulations in force, and also to those which may be issued in the future, in regard to the bridge and river passage, whereby the responsibility for complying with the regulations by those acting on behalf of the leaseholder and by his collectors remains with the leaseholder.

PAR. 10. The leaseholder is entitled to appoint collectors, according to his choice and judgment, under the condition, however, that the men shall be Russian subjects, and that a notice of their appointment shall be given to the local engineering authorities, the local police authorities, and to the commander of the fortress.

According to the regulation issued by the former Government committee of the interior and the police, dated June 6, 1825, No. 299/1250, the collectors on the day on which they enter upon their duties shall be provided with prescribed symbols on the chest and on the cap, and must be neatly and, if possible, uniformly dressed.

A special fine shall be inflicted on the leaseholder for the nonsuitable attire of the collectors and ferrymen, namely, 90 kopecks for the first time, and in case of repetition the fine shall be tripled.

The collectors are to comport themselves politely with the public, and be obliging, and must remain outside when receiving the bridge-passage tax.

The leaseholder assumes the responsibility for the behavior of the collectors, and also for the regular payment of fines inflicted on the latter.

These fines may be imposed by the local engineering authorities, according to the regulation of the former viceroy of the Kingdom of Poland, dated August 5, 1817. If the local engineering authorities are of opinion that the collectors or ferrymen are guilty of abuse of the service, incapable, or impolite toward the public, and that they should therefore be dismissed, the leaseholder must immediately comply with the request of said authorities.

PAR. 11. In order to give the public an opportunity of making complaints as regards abuse of duties by the men in charge of the bridge, a special complaint book issued by the management of the district must be provided for in the watch houses of the bridge and in the river tax office in the village of Serotzk, and placed in a conspicuous place.

These books must be kept in good order, without corrections or erasions, and must be produced at the request of the passengers. Each complaint should be reported by the leaseholder or his substitute, within three days, to the local engineering authorities, and accompanied by an exact copy of the complaint.

The tariffs of the bridge passage and river taxes, in the Russian and Polish languages, are to be placed close to the books referred to above, as well as a copy of the present contract. Besides this, copies of

the tariff, countersigned by the management of the district, are to be placed, under glass, on posts on both river banks and close to the bridge, as well as in the village of Serotzk, at such a spot as directed by the local engineering authorities.

PAR. 12. According to an order of the former Government committee of the interior and public worship, dated October 9, 1832, No. 6006/27242, the bridge passage tax from post messengers shall be collected at the post station together with post tax and paid over to the leaseholder at the end of each month at the chief post office.

To facilitate matters in this respect the leaseholder shall receive from the postal authorities record books for that purpose, as prescribed, but should another mode of account be adopted, the leaseholder must comply with same, and if necessary furnish the post office with proper blanks printed at his own expense.

PAR. 13. In case of a change in the tariff, or if the tariff for any reason should be suppressed, the Government may require, on three months' notice being given, to have the alterations enforced or to have the contract canceled altogether, with no responsibility on behalf of the treasury, and no claim whatever for this reason shall be made on the part of the leaseholder.

PAR. 14. It shall be the duty of the leaseholder to pay at fixed times the insurance premium for the insurance of the watch houses, and any other taxes for same, if they are fixed by the Government and concern buildings which are Government property. The leaseholder shall also pay all expenses in connection with the manipulation of the leasehold business, such as the printing of blanks for contracts, printing of the tariff, and also postal expenses for sending the record books and blanks. Within two weeks of the signing of the contract the leaseholder must produce 20 copies of same.

PAR. 15. The leaseholder is bound to control passengers according to articles 18 and 21 of the regulation of the former viceroy, dated February 12, 1822, which states that all traffic over the bridge shall be at a walking pace, and that no fires shall be lighted on the sand of the river banks or on the banks themselves within a distance of 233 yards of the bridge.

PAR. 16. The present contract engagements may be transferred to a third party by the leaseholder, but not prior to the conclusion of this contract and under the condition that in case of nonfulfillment of the contract engagements by the new party the party concluding the contract shall not be exempted from responsibility, according to clause 222 of the regulations governing contracts and supplies to the Government.

Besides this, such transfer of contract engagements can not be made otherwise than by authorization of the management of the district of Warsaw.

PAR. 17. In case of the nonfulfillment of any of the clauses of this contract the treasury is at any time entitled to have the taxes collected at the expense of the leaseholder by an official appointed by the treasury or to transfer the collection of the taxes to other parties by auction, and in the absence of bidders, without auction, it being understood that in case of transferring same at a lower price than that of the present contract, the leaseholder be held responsible for the difference, and in case a better price be obtained no claim for the difference on the part of the leaseholder shall be admitted.

PAR. 18. As guaranty for the fulfillment of the present engagements the leaseholder must deposit a security equal to one-half of the leasehold price.

This security, given at the signing of the present contract, consisting of 7,500 rubles in 4 per cent Government stocks, was deposited at the office of the Government treasury at Warsaw on December 16, 1903, under No. 22126.

The release of this security can not take place prior to the termination of the lease nor before the Government quarters and furniture, and also the barriers, etc., as per inventory, be handed over, all in good condition. In case of the transfer of the contract to another party (see par. 16 of the present contract) the release of the security can not take place prior to the fulfillment of all the engagements of this contract by this party, or should the treasury itself take over the lease on his account the repayment of same can only take place after the total close of the accounts.

PAR. 19. In all cases not specified by the clauses of this contract the management of highway roads and communications, as well as the leaseholder, are bound to act according to the governing laws in force in the Kingdom of Poland concerning contracts and such modifications and supplements as may occur during the term of the lease.

This contract, being duly signed, is to be observed by both parties solemnly and inviolably.

(Signed by the following: President of the management of the Warsaw Exchange Workmen's Association, Stanislas Krzeczkowski; member of the management of the Warsaw Exchange Workmen's Association, Antony, son of Francis, Kowalski; management of highway roads and communications in the Warsaw district, E. Hirszing; chief of the section, Rodkiewicz; bookkeeper, Bader.)

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